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ECONOMIC GEOGRAPHY

JANUARY

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CITIES OF CENTRAL MISSOURI
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THE OULD SOD OF EIRE

A LAND of green growth and gracious skies, of sea-beaten cliffs and boggy moors, of whitewashed crofts and hamlets set in a vital but tranquil landscape, of folk who treasure freedom and justice, and take ample time for friendship and neighborly living, Eire, "the ould sod" has not yet attained the place it will inevitably hold in due time as one of the most charming and picturesque of all vacation and recreation lands. Switzerland, Scandinavia, the Highlands of Scotland, the Riviera, or the shores of Brittany hold no greater charms and alluring countrysides than Eire.

Eire has prospered, and raised its standard of living, the last half century. It has established and expanded a sound national economy. Its agriculture flourishes, its manufacturing grows steadily, its trade develops. The benefits of coöperative enterprise are nowhere better illustrated than in the creameries scattered throughout the land, for Eire is a country of dairy cattle and coöperative folk. The Irish love their land, and make the most of its every advantage. They are industrious, energetic, and canny as the Scots, thrifty as the Swedes, genial as the Danes.

Its green moors and meadows, its soft air and skies, its rugged coasts and mountains, its sheep and cattle grazing on its broad pastures, and its well-tilled fields, combine to form a picturesque and placid landscape for its loyal, alert people. The pungent fragrance of peat smoke from low chimneys of its straw-thatched, colorful cottages set in groups about almost every crossroads, perfumes the whole countryside, from Galway to Dun Laoghaire, from Cobh to Armagh, and all the broad acres between.

ECONOMIC GEOGRAPHY

VOL. 23 JANUARY, 1947 No. 1

ALKALI PROBLEM OF WESTERN UNITED STATES

Harold A. Hoffmeister

ALKALI, the "white scourge" of the West, annually causes tremendous financial loss to the residents of arid and semi-arid lands of the United States. The total damage wrought by alkali cannot be estimated; yet there is little doubt that it causes property damage and crop losses comparable to those caused by insects or the more obvious and spectacular phenomena of nature, such as frost, hail, wind, and drought. The area affected and damage involved appear to be increasing yearly, and very little is being done to solve the problem. Approximately 12 to 15 per cent of the irrigated lands contain enough alkali to be harmful and there are many million acres of alkali land not irrigated. Few farms, especially on irrigated tracts, are unaffected in some degree. Alkali is so widespread and its damage is so commonly taken for granted that most people are inclined to overlook the seriousness of the situation.

Definition: The term "alkali" is used, in the colloquial sense, whenever reference is made to any white efflorescence or deposit of soluble salts on or in the soil in such quantity that they are visible and where the solution in the soil is sufficiently concentrated to injure plants. The term inaccurately conveys the impression that all such salts are truly alkaline in their reactions. This is not the case, for with exception of sodium carbonate practically all of the so-called alkalies are neutral salts. Yet the term "alkali salts" is so firmly established in agricultural literature and in colloquial speech in the west, that it is not likely to be displaced.

Two general classes of alkali are recognized—white and black. White alkali, the more common type, is composed of varying combinations of sulphates, chlorides, and nitrates of sodium, potassium, and magnesium, and chlorides and nitrates of calcium. When newly deposited the crystalline mass is nearly transparent, but upon exposure to the atmosphere the salts lose their water and become a pulverulent white powder. From a short distance, white alkali areas appear like a thin bed of dirty white snow. (Figure 1.)

Black alkali is much more destructive to vegetation and structural materials than is white alkali. It is formed whenever a large amount of sodium carbonate, and other salts, is present in the soil. Various combinations of the carbonate of soda and other salts appear as a white powder when dry. When moist they corrode or dissolve organic matter from the soil to give dark color to the solution and to the encrustation when wet. In wet weather, such infested areas become vile-smelling, gumbo-like muds, with the salts rather well distributed throughout the soil horizon. During dry weather, the surface of the muds dries into mud cakes, coated and impregnated with salt crystals. How-

ever, at varying depths the subsoil is likely to remain soft and mucky, in which livestock may become hopelessly mired.

ORIGIN OF ALKALI

There is no great problem involved in explaining presence of alkali salts in soils of dry regions where leaching naturally is very limited. All pedocal soils are lime-accumulating and contain greater or less quantities of all alkali salts, derived from decomposition of feldspathic and calcareous minerals originating in the parent material or that have been brought into the area from outside sources by water and wind. Fully developed pedocal soil normally reveals a zone of calcium carbonate at some point in the B horizon, where the lime content is higher than that of the A or C horizon. In regions of low rainfall the lime zone occurs near the surface, but in regions of greater rainfall the layer is found at greater depths. Although the percentage of soluble salts (salts of calcium and magnesium are most common, with sodium salts in the minority) in well drained soils might be high, they are so uniformly distributed as to cause little if any trouble, and such soils generally prove to be highly fertile. In fact, it has been repeatedly demonstrated that the salts in dilute solutions stimulate germination of the seed, and growth and transpiration of the plant.

It is only when alkali accumulates in excessive amounts that harm results. (Figure 2.) Such concentration may be brought about in many ways, either naturally or by human carelessness. Two conditions, however, are responsible for development of practically all alkali affected areas.

(1). When the water table is raised to or near the surface. The water necessary for the development of an alkali area may come from a number of sources, but in irrigated areas it is chiefly seepage from leaky canals (Figure 3), or excessive irrigation water. Alkali accumulation of this type develops best when an impervious stratum lies at a relatively shallow depth and when the overlying soil does not have good lateral

FIGURE 1.—An alkali "flat" on an area that was formerly agriculturally productive, but has become to all intents and purposes waste land.

drainage. Such a condition may prevail where either alluvial or residual soils rest on clay bedrock, or where an extensive hardpan has been formed in the subsoil. The water passing through the soil leaches out the soluble salts, and if drainage were adequate it would soon free the soil of much of its alkali. However, irrigation water in many districts contains much alkali even before it is applied to the land. Under conditions of impaired drainage, water percolates downward until it encounters the impervious layer and there collects in low places. When the water table has been raised sufficiently, capillarity carries the water to the surface. (The length of time required for the water table to rise to a harmful level will depend on several factors; depth of the impervious stratum, amount of water being added to the soil, rate of lateral drainage, and type of soil.) The water evaporates and the salts are precipitated, remaining on or in the soil. Rain water and subsequent irrigation may redissolve the salts and carry them downward to varying depths. In the course of all such movement, a layer of alkali concentration may develop at some depth within the soil. In time, as a result of the eluviation of fine clay particles from above, deflocculation of clay particles within the layer, and addition of more alkali from below, a "hardpan" may develop, to form an impervious layer that would further impair drainage and accentuate development of an alkali area.

FIGURE 2.—White alkali, with spots of black alkali, encroaching on tilled fields. Whether naturally produced, or through man's carelessness, it tends to restrict successful farming, and reduce arable area.

(2). When surface or sub-surface water accumulates in shallow depressions. Much of the rainfall and many of the streams over large areas do not find immediate outlet from the catchment basin, but collect in shallow depressions to form temporary playa lakes during the rainy season. Surplus and waste irrigation water, in many instances, is diverted and seepage water flows into such depressions. The water usually is heavily charged with soluble salts, that were leached from soils and rocks of the region. Eventually the water evaporates, leaving its load on or near the surface to form an alkali flat, so typical of playa and flood plain areas.

Once started the process becomes accumulative in its effect, as alkali tends to make the soil so compact that subsurface drainage is greatly restricted.

INJURIOUS EFFECTS OF ALKALI ON PLANTS

The primary injurious effect of alkali on plants is the impairment of their absorption of water from the soil. An ordinary plant, such as wheat, normally absorbs and transpires several times its own weight of water each day. But relatively large amounts of salts in solution in the soil create an artificial drought condition that seriously hinders the process of osmosis in the plant. Whether other growing conditions, such as temperature and depth and fertility of the soil, are favorable is of little consequence. If absorption of water is retarded, growth of the plant is retarded. If absorption is prevented, the plant dies.

Heavy spring rains or early irrigation may so diffuse alkali throughout soil that seeds may germinate and plants begin their growth. But as the season advances, alkali rises through capillary action and becomes concentrated at the surface. Subsequent rains or irrigation may force alkali down to the roots, where solution concentration becomes so great that absorption is affected. If solution concentration is not too high the plant may survive, but with its supply of water and food diminished, it slowly starves and its yield is greatly reduced. If solution concentration is very high, water may pass out of the plant through the root cells into the soil solution leaving the plant cells in a plasmolyzed condition. The plant turns yellow and withers; farmers say it is "burned out."

Strong concentration of alkali may entirely prevent or greatly delay germination of seeds. If solution concentration is very high, seed may be unable to absorb any moisture and no growth can take place. If concentration of alkali is not too high seed may absorb some moisture, germinate, and begin its growth. However, germination may be delayed for several weeks, and if the delay happens in a region having a critically short growing season the plant may be unable to reach maturity before autumn frosts occur.

FIGURE 3.—Heavy encrustation of alkali, resulting from seepage from a nearby irrigation canal and consequent raising of the watertable and excessive accumulation of alkali.

Under some conditions alkali may seriously injure the plant through its corrosive on vegetal matter, especially true of "black alkali", which in addition to its plasmolyzing influence, cor-

rodes or dissolves parts of the plant with which it comes into contact, often apparent in orchards. Roots of trees may be sufficiently deep to escape injury from the surface alkali, but where black alkali on the surface contacts the trunk of the tree corrosion may penetrate so deeply into the bark that flow of sap may be retarded or entirely prevented. The entire foliage of a tree so affected may present an unhealthy, wilted appearance; a few branches may not put forth leaves; or, the entire tree may die.

Tolerance of Plants to Alkali: Concentration that alkali may attain before it is injurious to crops depends upon so many conditions that it is impossible to give quantitative figures that will apply in all cases. Some crops are highly tolerant to alkali activity and can withstand concentrations that would be deadly to other crops. Two factors are largely responsible for the varying degree of tolerance: (1) physiological constitution of the plant, and (2) its rooting habit. Little is known, as yet, about the first, so much depends on character and activity of the cell contents, nature of the cell walls, and character of the alkali solution. Soil, moisture, and weather often change the relative tolerance of the different crops. Furthermore, toxicity of two salts, when together, is considerably less than the sum of their injurious actions when acting alone.

Percentage of Total Salts in the Soil	*Percentage of Black Alkali in the Soil*	*Type of Crops*
0.00–0.20	0.00–0.05	All crops grow, including sensitive fruits.
0.20–0.40	0.05–0.10	Onions, potatoes, young alfalfa.
0.40–0.60	0.10–0.20	Oats, wheat, vines, beans, barley.
0.60–1.00	0.20–0.30	Old alfalfa, kaffir corn, sugar beets, grain sorghums.
1.00–3.00	over 0.30	No crops or plants grow.

Rooting habits of plants in their relation to alkali tolerance are well known. Shallow rooting crops, such as cereals and cultivated grasses, are at a disadvantage where alkali tends to concentrate near the surface, unless the alkali can be diluted and driven downward by irrigation. Deep rooting crops, such as sugar beets or alfalfa, usually are quite tolerant, probably because a portion of the root may be in a less strongly impregnated part of the soil. Young alfalfa, however, is rather sensitive to alkali; but if the alkali can be kept below the feeding zone of the roots by irrigation while the plant gets a good start, satisfactory crops may be secured.

FIGURE 4.—Disintegration and decomposition of the concrete lining of a canal due to alkali action; it may allow seepage to develop to such extent that lower land may become saturated.

INJURIOUS EFFECTS OF ALKALI ON SOILS

Likelihood of injury to soils by alkali varies greatly with original character of the soil itself. A light sandy well-drained soil is only slightly affected by alkali salts, but heavy poorly-drained soil is quickly and seriously affected by the introduction of alkali. Five significant changes may take place in the soil when alkali becomes greatly concentrated.

(1). Change in structure or tilth. Structure of the soil is perhaps as impor-

tant to growth of plants as is its fertility. Good soil is one in which the fine soil particles are clustered together, or flocculated, in such a manner as to provide maximum circulation of both air and water. Alkali not only tends to prevent flocculation but some types of salts, notably nitrate and carbonate of soda, cause deflocculation of the particles, to produce "puddling" of the finer particles, causing a crust at the surface and compacting the soil to such extent that little air or water circulation is possible. Such soils plow up into large, hard clods. Further cultivation may break down clods but it never seems to secure the mellow, friable structure of good soil. In winter such soils tend to heave in freezing, resulting in killing of winter crops.

(2). Change in colloids. Many physical changes brought about in soils by alkali come from effect of salts on colloids. Colloidal material in soil is of great significance in growth of plants. The colloidal mass not only provides easily available food for plants, but it tends to hold soil moisture in place and maintain good tilth. Destruction of colloids leaves soil hard, compact, and a very poor medium for plant growth.

(3). Change in bacterial life. One of the most injurious effects of alkali on soils is destruction of beneficial micro-organisms. In weak concentration the salts decidedly stimulate action of all micro-organisms, but in stronger concentration salts may greatly reduce or completely destroy bacterial life. Thus, even after salts have been diluted or removed, soil remains sterile for long periods.

(4). Change in moisture relations. Normal behavior of soil moisture is greatly altered by presence of strong concentration of alkali salts. Whereas, sodium carbonate considerably increases capillary rise of water, other neutral salts very materially reduce capillary activity. Furthermore, presence of alkali greatly reduces rate of evaporation from the surface. All this naturally affects not only soil but plant growth, as well.

(5). Formation of hardpan. Most hardpans, formed in arid and semiarid regions, result from concentration of calcium carbonate, or other salts, at slight depths in poorly drained soils. Typical alkali hardpan averages about six inches in thickness and underlies an area from 5,000 to 12,000 square feet at a depth of perhaps 14 to 24 inches. Generally it becomes so strongly cemented that it can be broken up with a plow only with great difficulty. Not only does hardpan interfere with drainage of surface water and downward penetration of roots, but it limits supply of food available to plants.

INJURIOUS EFFECTS OF ALKALI ON LIVESTOCK

Most alkali salts are in varying degrees harmful to livestock. Sodium Sulphate (Glauber's Salt) and Magnesium Sulphate (Epsom Salts) are especially bad; being strong purgatives under all conditions, and actually poisonous in large or concentrated doses. Usually livestock gradually becomes immune to effect of alkali of the amounts contained in most surface and well waters. However, it sometimes happens that after a long, dry drive, thirsty stock, especially sheep, come to strong alkali water, where they overdrink and perish in great numbers. (Folk in alkali water regions, soon develop immunity, even to strongly concentrated alkali water, but newcomers frequently get violently sick on water used without harm by the inhabitants.)

INJURIOUS EFFECTS OF ALKALI ON STRUCTURAL MATERIALS

Almost all types of structural materials are affected by action of strong

concentrations of alkali. Economic losses therefrom are inestimable in amount, but they certainly are extremely great. The life of many materials is greatly shortened by alkali action, which necessitates frequent and costly replacements. A more subtle, and perhaps more serious consequence of alkali action on structural materials, is failure of the structure to properly perform the function for which it was designated. Several examples may be given. Disintegration of subsurface clay tile may prevent proper drainage

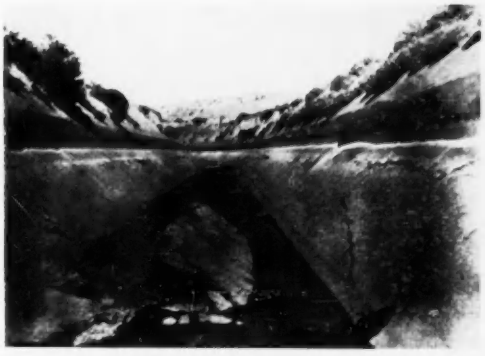

FIGURE 5.—Cracking, crumbling, and buckling of the concrete lining of a canal due to the action of alkali. The concrete thus becomes more vulnerable to chemical action and disintegration.

of a tract of land and cause of the drainage failure may not be discovered until after irreparable harm has been done to the soil. Breakdown of the concrete lining in a dam or canal (Figure 4) may allow seepage to develop to such extent that lower land may become saturated.

Alkali salts, particularly sulphates of sodium and magnesium and carbonate of sodium, strongly attack most types of concrete, both chemically and physically. In the first place, chemical decomposition takes place with loss of silicic acid and calcium constituents by leaching, thus destroying the binding properties of the concrete. In the second place, physical disintegration is produced by the mechanical force exerted by crystallization of salts soaking into pore spaces of the concrete. Cracking, crumbling, and exfoliation result (Figure 5); all of which make the concrete more vulnerable to chemical changes. Concrete mixed with aggregates already containing alkali is especially susceptible, and in many regions it is almost impossible to obtain aggregates free from the salts. Rough surfaces are more affected than neat surfaces, and tarring the surface effectively protects concrete from attack. Alkali resistant cements are now available on the market, but many structures are still being made with ordinary cements.

Alkali causes "brooming" of timber, as illustrated in Figure 6. Timber supports for flumes, bridges and buildings, telephone poles, and fence posts, are soon decomposed wherever they rest in soils having high alkali content. Treatment of timber in a hot bath of creosote or similar material increases its life considerably, but if the treated surface of the timber is broken deep enough to allow infiltration of alkali solutions decomposition may occur within the heart of the timber. The manner in which the injury is produced is similar to that described for concrete. Certain salts actually corrode wood cells; others cause brooming through recrystallization of salts impregnating the wood.

Brick, tile, many building stones, uncoated iron and steel, and other structural materials are likewise affected. Many handsome buildings resting on alkali ground have not only been disfigured by unsightly efflorescence of salts that have gradually crept up the walls of the structure but have been seriously harmed by weakening of their foundations, that caused cracking of walls and stairways.

EFFECT ON THE ATTITUDE OF FARMERS

Development and spread of alkali on a man's farm often results in a significant change in the owner's attitude and performance. A farmer, who had always been industrious and progressive, may develop an attitude of defeatism when alkali spreads over his farm, often through no fault of his own. The alkali may result from the careless and over-use of irrigation water by some farmer higher up on the slope of the land, or it may result from seepage out of a canal or reservoir above his farm. Perhaps, because of location of his farm he is unable to employ the measures that would correct damage and prevent further spread. It might be result from his inability to finance necessary drainage or it might be due to lack of coöperation from his neighbors. Thus, he is unable to prevent the damage, and more and more of his farm is affected. Discouraged and bitter, he may neglect his remaining land, his barns, fences, and crops.

CONTROL AND ERADICATION OF ALKALI

Management of alkali soils requires careful study of the individual situation. It is dependent on many factors, such as: type of soil, slope, proximity to drainage outlet, depth of water table, climate, type of alkali, land values, and the like. Many techniques have been devised for control of alkali, but such measures are temporary at best, unless it is possible to eliminate the source of new alkali and to eradicate surplus accumulation within the soil. As has been pointed out, salts in solution are brought to the surface by capillarity, where evaporation causes harmful concentration of alkali in the upper part of the soil. Thus, if evaporation is minimized accumulation of alkali may be checked, in several ways: (1) by frequent cultivation, in which the surface crust is broken and capillarity is destroyed, (2) by mulching the soil with the addition of manure, straw, or sand, (3) by shading the soil, preferably by a crop which not only shades it but also causes soil water to pass into the air through the plants without first coming to the surface.

When alkali is concentrated near or on the surface its injurious effects may be lessened by plowing it deep into soil, and thus decreasing its concentration to tolerable limits of the crop for a short period. Flushing the soil surface is a temporary device for removing excessive alkali. Usually the land is prepared in such manner that water can be made to stand several inches deep for several hours or until much salt is dissolved. Under some exceptional circumstances, heavy concentration of alkali on the surface has been removed by scraping off the upper few inches of soil. However, land carrying so much alkali as to admit of either flushing or scraping, usually is so heavily impregnated as to render such methods rather ineffective.

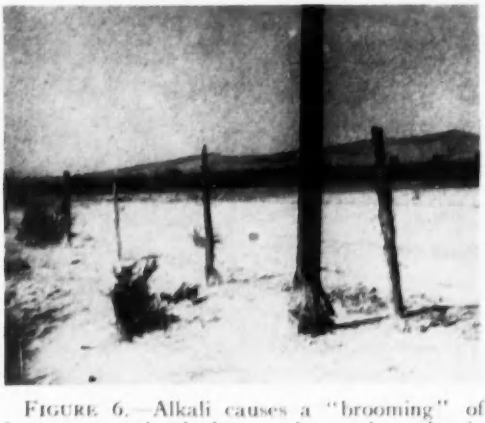

FIGURE 6.—Alkali causes a "brooming" of fenceposts and telephone poles, and results in their eventual destruction for useful purposes.

Black alkali can be rather effectively neutralized for short periods through use of gypsum. Calcium sulphate, in

the presence of moisture, enters into combination with sodium carbonate to form less harmful and more easily managed sodium sulphate and calcium carbonate. Other chemical substances, such as sulphur, nitric acid, and sulphuric acid, have been used with some degree of success.

The only permanent method of controlling and reclaiming alkali land, is to eliminate the source and to remove all excess salt from the soil, through installation of some system of drainage in association with one or more of the above mentioned methods of reducing injurious quantity of alkali. Salts, leached out of the soil by percolating rain and irrigation water, will be carried away from land by drains. The drainage system (Figure 7), to be effective, must be deep enough to lower the water table below depth of the crop roots. Two types of drains may be used: (1) sub-surface tile or concrete drain, or (2) open-ditch drain. Advantages and disadvantages accrue in the use of either type of drain. An open ditch can usually be constructed more cheaply than a sub-surface drain. However, open ditches may materially reduce effective farm acreage and also interfere with normal farming activities. They must be cleaned of weeds and other obstructions at frequent intervals. On the other hand, materials of sub-surface drains, laid in strong alkali soil, may quickly be decomposed and disintegrated by action of the alkali, the drain becomes clogged and its effectiveness destroyed. The entire drain may have to be exposed and tile replaced. Replacement costs, together with the original costs, may be so high that the farmer cannot afford to maintain the system. In discouragement, he may terminate his efforts to control alkali and abandon the land to its fate.

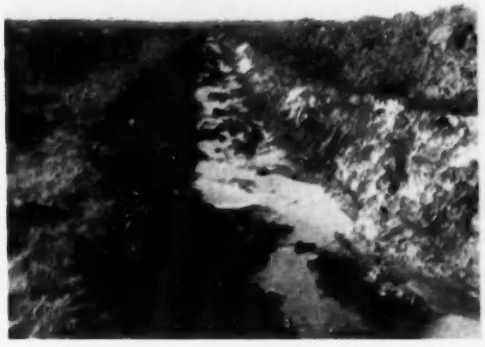

FIGURE 7.—A large drainage canal cut through an alkali flat. The white encrustation of alkali on the sides of the canal reveals its heavy concentration in the water drained off the area.

Even after land has been effectively drained and salts removed, soil must be carefully worked to again restore its original productivity. Its tilth must be built up and its beneficial micro-organic life restored. Given sufficient time, nature alone may bring about its reclamation but the process may involve disuse of the land for many years or even decades. The usual practice is to work the soil diligently and try to produce crops on it as soon as possible, even though yields are low. The addition of coarse sand, cinders, or straw is of value, as they open the soil to passage of water and air.

Conclusion: Alkali presents one of the most serious problems facing agriculturists of the western half of the United States. As long as farm land remains relatively cheap and supply of food remains adequate for our needs, we can not expect much improvement in the situation. But as pressure of population on our food supply becomes more acute, greater attention and more intelligence in handling and reclaiming alkali lands will be needed.

PEASANT LIFE IN THE GLENS OF ANTRIM

Eila M. J. Campbell and U. Donnelly

THE Nine Glens of Antrim (Fig. 1) are well known to British sportsmen. They are no less interesting to the geographer, for they reveal several thriving communities of peasant farmers, set in an environment, which, by reason of its rigor, might well defeat their energy and initiative. The people, however, have attained, despite difficulties which beset them, a relatively high standard of living. Indeed, it may well be said of the Glen farmers that not only have they withstood, but also overcome their environment, seeking from it the very best that valley floor and mountain slope are capable of yielding.

The Glens are the only places amidst the wild and difficult terrain of the mountains of Antrim where people may win a living. The mountains rise steeply from the coast to over 1,500 feet before falling away gradually towards the west. They are, in fact, up-tilted edge of a lava plateau which once extended from Antrim through the Western Isles of Scotland into Iceland and Greenland. The great lava field was formed during the Tertiary Era when violent volcanic activity resulted in separate outpourings of basalt, which in Antrim metamorphosed the chalk over which they flowed. Today in the valley sides, the metamorphosed chalk gleams brilliantly under thick layers of black basalt, and offshore small black and white "gull islands" show the contact of the two formations even more clearly. The general surface level of the rugged treeless plateau stands at 1,000 feet, crowned in parts by isolated summits, some of which are remains of central-vent volcanoes long since extinct. During the Quarternary Ice Age glaciers deepened and widened the valleys, and on their retreat, deposited over parts of the plateau surface, large areas of impermeable boulder clay, much of which, today, is undrained bog-land. In this hard land of bare rock, bogs and exposed heights, the glens are comparatively sheltered, but even they can present a very bleak appearance during winter, when swept by the bitter winds from off the plateau as well as from the sea, never far distant.

FIGURE 1.—Northern Ireland—The Glens of Antrim.

Throughout the Nine Glens size of the farms, crops and methods of farming employed are substantially similar. Such uniformity imposed on the agricultural pattern by physical environment does not mean that the separate Glens lack distinctive character. Rather is it true to say that the various communities are highly individual, distinguished from each other by characteristics which

they have retained over a long period, due to difficulties of inter-glen communications prior to the present century. The two most striking of all the Glens are Glenarm and Glenariff (Figs. 2a and 3a).

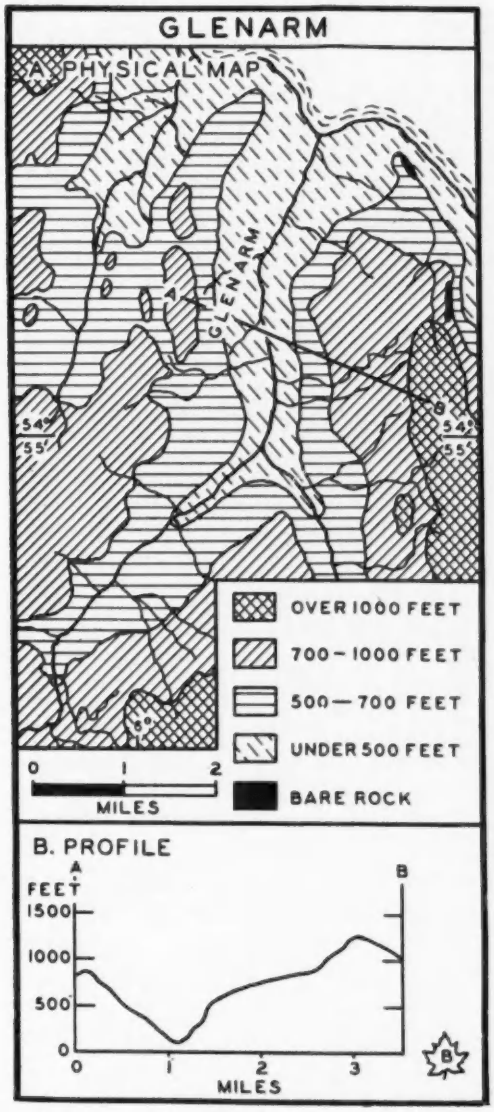

FIGURE 2.—2-a Physical map of Glenarm. 2-b Cross-profile of Glenarm.

Glenarm, marked by its outstanding air of prosperity is nearest Belfast, the capital of Northern Ireland. It has a narrow marshy floor over which flows the river Glenarm, well known to salmon fishing enthusiasts. The valley sides rise gently, to merge gradually at about 750 feet into the treeless moorland of the plateau, which here stands at a lower altitude and presents less rugged features, than farther north (Fig. 2b). The majority of the Glenarm farmers are descendants of the Presbyterian Scots who, during the 17th century, crossed the narrow channel, which has never proved itself an effective ethnic barrier between Scotland and Ulster. So close were ties with Scotland that the first generation used to row back once a month to take communion at their Ayrshire presbytery. Today the Presbyterian Community forms 90% of the total population and the most common names are derived from Lowland Scotland. The people, as were their ancestors, are proud, thrifty and hard-working and not given to spending much time or money on amusement. Their small farms, averaging thirty acres in size, lie along the valley sides between 500 and 700 feet, with many fields invading the rough pasture of the moorland. Farmhouses are neat, whitewashed buildings, comprising two floors of four to five rooms; likewise out-buildings and gates present a well cared for appearance. Testifying to the essentially practical out-look of the people is total absence of gardens. Flowers and fruit having no marketable value in this part of Ireland, are considered luxuries and time therefore cannot be wasted on their cultivation.

Fields surrounding farmhouses are generally small, separated by thick hedges or stone walls, and, as in all areas where crop raising is hazardous, the largest and best field is given over to two or three crops. The greater part of the farm-holdings are laid down in permanent pasture as each farmer has a small herd of dairy cattle and also

rears beef cattle for the market. High rainfall and limited sunshine restrict choice of crops to oats, cabbages, potatoes, flax and sown grass planted in rotation; cabbages usually inter-cropped with potatoes, provide major part of the winter fodder and are known locally as "cow cabbages." In the years before 1939 flax was a vanishing crop, as the famous Irish linen mills of Belfast were using imported varieties. However, during the recent war it came back into its own again, because its cultivation was heavily subsidized. The Glen farmers therefore, opened up and cleaned out the retting ponds, of which there is one on every farm, dating from days when flax was the chief cash crop.

Assured markets of wartime, which the farmer hopes will continue during the post-war period, have promoted prosperity, for cost of living has not risen appreciably, especially as, independent of hired labour, the farmer has not had to meet the demand for higher wages. Moreover, he has been encouraged by the Ministry of Agriculture to rear his young bullocks to maturity himself, rather than sell them for fattening on English or Scottish pastures. By selling directly to the butcher he greatly increases his profits. On the other hand there has been much grumbling amongst the highly individualistic people against the wartime imposition of officials, forms and restrictions. Each week farmers' wives are required to sell a quota of eggs and butter to the Ministry of Food. Testing and labelling which accompany this are regarded with great contempt by many families. Despite all inconvenience and annoyance of wartime regulations, "many a tidy little sum," has found its way into bank, box or stocking, for, as in peasant communities the World over, there still remains the feeling that savings are only secure when they are hidden in the home.

Much that has been said about Glenarm is applicable to Glenariff, lying eight miles further north. Yet the character of its community presents, in many ways, a complete contrast to that of Glenarm.

Glenariff is cut into the plateau which here reaches over 1,000 feet and is much more rugged and impressive than the rolling moorland surrounding Glenarm. The Glen has a broad flat floor, formerly an arm of the sea, with steeply rising sides which terminate in bare precipi-

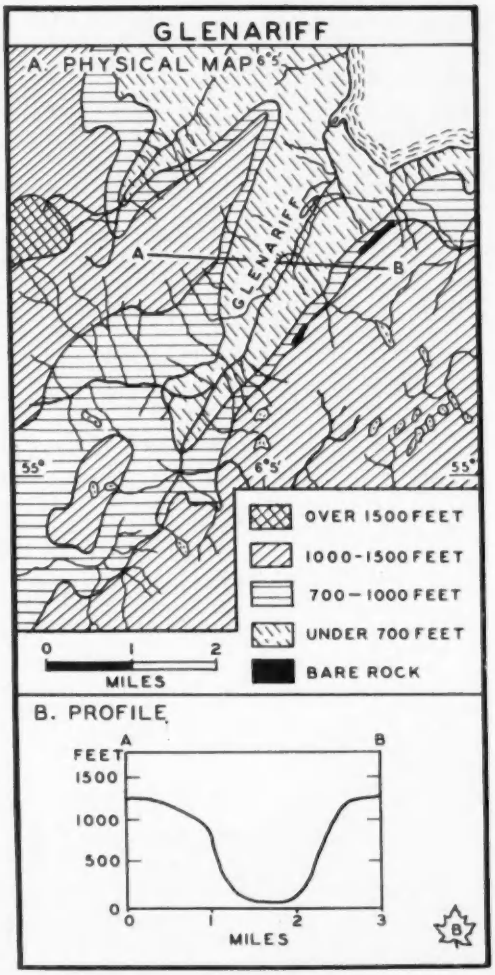

FIGURE 3.—3-a Physical map of Glenariff. 3-b Cross-profile of Glenariff.

FIGURE 4.—The Village of Glenarm and the Bay. On the left can be seen the chalk in a hillside quarry and in the background the level surface of the tree-less plateau.

tous basalt cliffs, completely separating the valley from the plateau top (Fig. 3b). At the head of the Glen is a miniature "national park" which attracts tourists because of the surrounding beauty of the wooded slopes and the picturesque waterfalls, one of which is known as "Tears of the Mountain."

Ethnic composition of the Glenariff community is different from that of Glenarm. The people are descendants of what are known locally as the "Old Scots," who came over from the Western Isles of Scotland during the early 16th

FIGURE 5.—The lower part of Glenariff showing the broad flat floor and steep sides.

century. Their religion was Roman Catholicism, and so is that of their descendants over four hundred years later. The grey stone cottages in this Glen indicate less prosperity than the larger, freshly limed houses of Glenarm. On the other hand each cottage is rendered attractive by profusion of flowers round doors, and in summer the hedges, separating the gardens from the road, are bright with trailing fuschia. The settlements are aligned along the break of slope between the cultivated floor and the rough pasture of the steep valley sides. Another feature distinguishing the two glens is the rich fund of folk-lore which the people of Glenariff possess. While the descendants of the Presbyterian Scots in Glenarm, neither inherited any such knowledge from their stern ancestors, who would have regarded it as superstitious nonsense, nor did they absorb any from the native Irish, of whose fate, during the settlement, little is known.

The social structure of the peasant communities is simple. Marriage is late as in most parts of Ireland, but the number of children per marriage although declining, is still high, especially amongst the Catholic communities. There are two main reasons why large families are considered an asset. First, they ensure continuity on the land, for a source of pride to each farmer is the number of generations before him on the family farm, a heritage he has carefully preserved. Secondly, since the family provides all the labour, children are a definite economic asset. Any surplus young men from the Glens go to sea in the service of the Merchant Navy, as they have a strong sea-faring tradition. The girls find, as a rule, sufficient work at home and rarely leave the Glens to take up employment elsewhere. During the early years of the present century there was much emigration from Antrim to the U.S.A., Canada, Australia and New Zealand. Today, the outward movement has virtually ceased, and populations of the Glens appear to have become stabilized, thus ensuring a small but quite comfortable measure of success for those who have remained behind.

BANANA TRADE OF BRAZIL

Earl B. Shaw

PRE-WAR shipments of bananas from Brazil placed that South American country high among the world's leading banana exporters. In marked increase between 1929 and 1935, outgoing Brazilian cargoes rose from fewer than six million stems to nearly eleven million. No doubt the upward trend was influenced significantly by the coffee crisis which showed the need for more diversity in farm production and export. Only Jamaica, Honduras and Mexico exceeded Brazil in the middle 1930's, Figure 2, and by 1940 world leadership passed to Brazil, not because of greatly increased Brazilian trade, but because of declines in Middle American export. Sigatoka began inroads on Caribbean plantations by 1935 and in the fall of 1939 war accelerated decline in shipments caused by disease. In contrast prior to 1942 Brazilian bananas could reach nearby Argentina, Brazil's best banana customer, with comparative ease. In 1940, the Brazilian port of Santos, Figure 1, the world's greatest coffee port, was also the world's greatest exporter of bananas accounting for a total shipment of 10,121,403 stems. In that same year Brazil produced 91,667,200 bunches, probably giving her world lead in production. Brazil also led in consumption with a figure of approximately 80,000,000 stems, greatly exceeding that for second place, the United States.

Bananas are grown throughout the greater part of the South American republic and few homes, no matter how humble, are without them. Even in the large orange producing sections, small plantings may be seen around the tenant houses in the heart of the citrus groves. Brazilian bananas may be classified as cooking bananas, such as the *Musa Paradisiaca*, including the São Tomé and Maranhão; and those eaten raw, like *Musa Sapientum*, of which Gros Michel is the best known representative, and *Musa Cavendishii* which includes Nanica and Nanicão. Since Nanica furnishes most of Brazil's normally significant export, that variety will receive the major attention in the following paragraphs.

The Nanica

Nanica dominates Brazilian banana export just as the Middle American Gros Michel features United States banana import. A few Gros Michel and Nanicão go out of Brazilian ports, but Nanica accounts for the bulk of the trade.

Nanica, *Musa Chinensis* Sweet (*Musa Cavendishii* Lamb) is known by many names. They include Chinese, Governor, Dwarf, de Italiano, d'Agua and Cathurra. The plant grows from five to seven feet high, only about one-third the height of the average Gros Michel. However, the trunk is broad and robust. This characteristic, together with the plant's low height and meter-long leaves borne on short petioles, minimizes danger from wind. The fruit ranges from twelve to eighteen centimeters in length (four and three-quarters to seven inches), and averages about eight hands to the stem. It doesn't color up as well as the Gros

Michel and bruises more easily, but it has the great advantage of being far less susceptible to wind and disease. Barrett says that it can be set out in Gros Michel fields that have been ruined by Panama disease and suffer no damage. Other varieties suffer from a disease somewhat similar to Panama disease which has been reported from various isolated parts of Brazil but has not yet assumed great economic importance. The most important case occurred in the region around Piracicaba, São Paulo, and was reported on the variety Muga by Dr. Rosario Averna Secca, Director of the studies of banana diseases at the Institute Biologico de São Paulo, in Piracicaba. Studies proved this disease called *Mal de Piracicaba*, to be caused by a fungus *Fusarium sp.* but, though the symptoms are typical of Panama disease, identification with *Fusarium Cubensis* has not yet been made. (Lund, Charles E., Acting Chief, Foodstuffs Unit, Department of Commerce, Washington, D. C., personal letter, May 5, 1945.) Sigatoka disease is non-existent, according to the same author.

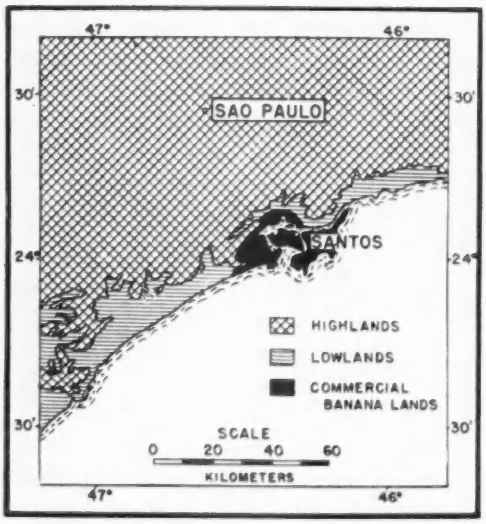

FIGURE 1.—Bananas are grown throughout Brazil, but approximately 90 per cent of the export crop is produced on coastal lowlands near Santos.

Planting of Nanica takes place, not with seeds, always with choice selected shoots from a foot and a half to two feet long, placed from twelve to fifteen feet apart. They grow well in the tabatinga soils of the alluvial coastal plains in Southeastern Brazil, developed from parent material brought down from escarpments of the nearby plateau by numerous streams crossing the coastal zone. Tabatinga soils contain large percentages of clay and humus, the ideal being forty per cent clay, forty per cent humus, twelve per cent lime and eight per cent silica. While export areas include coastal sections extending all the way from the state of Rio de Janeiro to Santa Catarina, ninety per cent of the shipments come from the São Paulo Lowlands not far from the city of Santos.

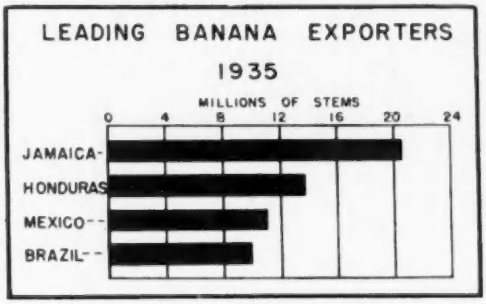

FIGURE 2.—Three countries, all bordering the American Mediterranean, led Brazil in banana exports in 1935.

Nanica plantings produce throughout the year, harvest coming at intervals of from fifteen days to a month, depending upon available labor, transportation facilities and demand. Picking takes place from twelve to fourteen months after planting and is much easier than of the Gros Michel because Nanica plants are so much smaller.

PRODUCING UNITS

Both big scale and small scale production may be found in regions producing

for export. Some plantations have an area of from twelve thousand to sixty thousand acres each, and most large ones are well organized for export

FIGURE 3.—Trunks of trees felled from the tropical rain-forest still remain on this recently developed plantation; but rapid decomposition will take place within a few years in such an environment. (Courtesy Brazilian Government Trade Bureau.)

trade. Care is taken in site selection with regard to land forms, drainage, soil and availability of adequate transport. After a plantation site has been chosen, land is cleared of its virgin rain forest, Figure 3, drainage ditches are dug, and planting takes place. Generally speaking, fields are given careful attention during both growing and harvesting periods. Although wide areas of Brazil's Southeastern Coastal Plain are sparsely populated, adequate labor supply may be found in vicinity of major coastal ports from which bananas are shipped. Most laborers live in small dwellings on the large fazendas and are given ground for producing their own vegetable and fruit crops.

Small scale growers also produce Nanica bananas for export in the coastal lowlands. Many band together and form coöperatives through which problems of harvest, shipment and sale are handled for the entire group.

Both large and small scale growers find climatic conditions generally favorable in the coastal zone of the South-

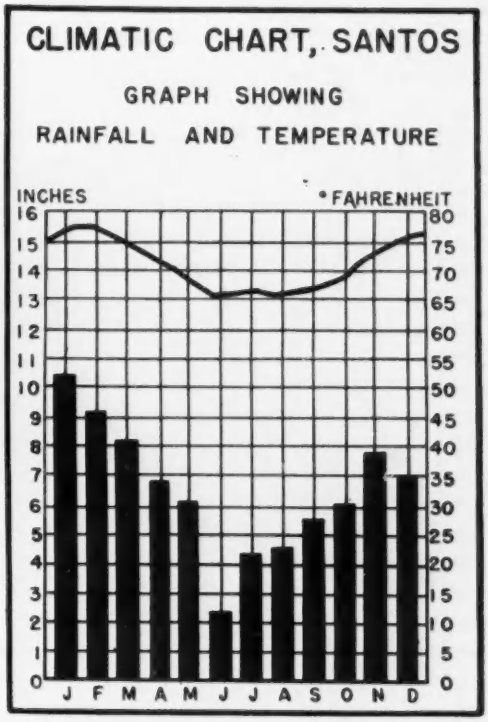

FIGURE 4.—While climatic conditions on the Santos lowland are generally favorable for commercial banana production, it may be noted that July rainfall is lower than the ideal. Temperatures in the cool season are also slightly lower than optimum.

east, Figure 4. The consistently heavy rainfall makes irrigation unnecessary. Landward-moving air-masses pick up much moisture passing over the warm South Atlantic and the warmer south-flowing Brazilian Current and are cooled in rising over the eastern escarpment of the Brazilian Plateau. Much of the

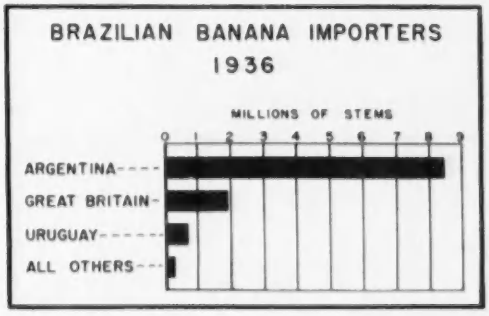

FIGURE 5.—Nearby countries dominate the purchase of Brazilian bananas.

rainfall is convectional. Such conditions largely account for the plentiful well-distributed precipitation. Lowland location of the producing area in tropical and sub-tropical latitudes encourages high temperatures throughout the year.

FIGURE 6.—The coastal inlet in the background provides a route to Santos for banana exports. (Courtesy Brazilian Government Trade Bureau.)

Brazil is entirely free from tropical hurricanes, the destructive storms that handicap Middle American banana production.

IMPORTING COUNTRIES

Most Brazilian export bananas go to Argentina. Geographic conditions largely account for the trade. Approximately ninety-three per cent of Brazil lies within the tropics, natural habitat of the banana, whereas a larger per cent of Argentina is included in temperate latitudes. Northwest and Northeast Argentina are the only sections of the country where any possibility exists for developing banana plantations successfully, and they show definite handicaps.

A part of Northwest Argentina is tropical, but here altitudes are high with a consequent decrease in temperatures. Low precipitation makes irrigation necessary. The Northwest is also far removed from the densely populated lands of the La Plata estuary.

Temperatures are not entirely unfavorable for banana production in sub-tropical Argentine Misiones, although interior location a few degrees south of the Tropic of Capricorn forms frost hazard. Probably a greater handicap arises from danger of inadequate precipitation along the leeward southwestern section of the Parana Plateau, included in northern Misiones.

Many other obstacles face banana production in Misiones and Northwest

Argentina. All in all, Argentina's environment is not suitable for commercial banana growing and is much better fitted for producing temperate latitude crops. Differences in location thus give Brazil and Argentina a sound basis for trade.

Brazil has not yet tapped the United States market for bananas. That largest of world banana markets is distant, and trade is based almost entirely on Gros Michel, produced in large quantities on Middle American plantations. Europe is also far from Brazil, but prior to World War II, Brazilian banana exports were increasing to western European countries. Great Britain stood second as an importer, Figure 5, prior to the last World War, but imports ceased during the conflict.

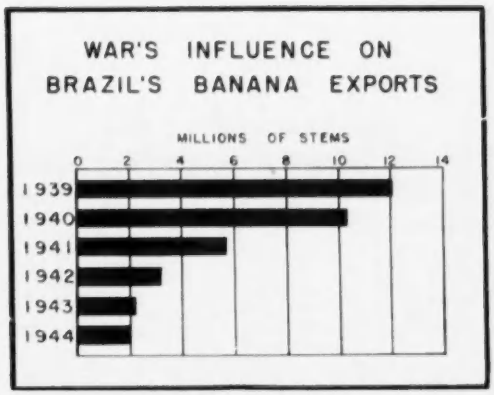

FIGURE 7.—Brazil suffered more in the Allied cause during World War II than any other South American country. The decline of her banana trade was a small part of this loss.

Neighboring Uruguay, much smaller in area and population than Argentina, stood third in rank as an importer before the War and second thereafter. Uruguay's location, entirely south of the Tropic of Capricorn brings a frost hazard; and her position at the outer limits of the Southeast Trade Wind Zone, together with absence of a coastal escarpment to wring moisture from inflowing air, limits rainfall far below the ideal for banana production.

TRANSPORTATION

Bananas are brought to Santos, the major banana export entrepót both by land and water carriers. The nearby lowlands are intersected by a number of navigable streams, Figure 6, which provide a cheap route from the plantations to outgoing steamers or Santos docks. Big producers may own several small craft, useful for shipping fruit to the assembling ports. However, there are no fleets of large ships belonging to companies like the United Fruit Company, which operates in Middle America and which prior to World War II owned scores of large vessels suitable for carrying banana cargoes all over the world.

FIGURE 8.—Nanica suffers little wind damage because of the short thick trunk and the comparatively small leaves. (Courtesy Christovam Leite de Castro, Secretráio-Geral, Instituto Brasileiro de Geografia e Estatistica, Conselho Nacional de Geografia.)

WAR INFLUENCES

World War II with its exorbitant demands upon shipping cut sharply into Brazilian banana export just as it did into that of Middle America. Brazil came into the conflict early, and largely as a result paid a higher price in shipping losses than any other Latin American republic. Even without U-boat sinkings, banana exports would have been curtailed because cargo space was needed for strategic materials carrying much higher priority. From an average annual export of approximately 10,000,000 stems between 1933 and 1940 shipments dropped to 5,697,982 stems in 1941 Figure 7, 3,221,389 in 1942, 2,150,000 in 1943 and a low of 2,000,000 in 1944.

Partially to offset war-time loss of exports of the raw fruit, larger quantities of Nanica went to drying and dehydrating plants. One of the Brazilian processors uses the following system: bananas for dehydrating are first conditioned in a hot-house from six to twelve hours and then stored in a well-ventilated room for two or three days to ripen. They are then skinned by hand and placed in a drum. Carbonic gas is pumped into the drum to remove oxygen from the fruit. A screw conveyer carries them to a vat where they are whipped into a cream. The cream is piped to a dehydrator where thin films of it are spread on a large cylinder heated to about 360 degrees F. When dried the film is deposited in an air conditioned chamber and ground to powder which is allowed to stand in chilled cans until it cools. It is then put in an air-conditioned room, and packaged by hand. Ten tons of bananas are required to make about one ton of dehydrated material which tastes and

FIGURE 9.—Nanica growing on field of "Granja Cruzeiro do Sul," "Comissão Brasileiro-Americana de Producão de Generos Alimenticios." Courtesy Christovam Leite de Castro, Secretário-Geral, Instituto Brasileiro de Geografia e Estatistica, Conselho Nacional de Geografia.

smells like bananas. Exports of processed bananas reached 190,452 pounds for the first six months of 1943 and the trend of processing and export was upward. A large market for processed fruit is found in the United States, although one factory shipped about 80 tons of dried bananas to British war prisoners in Germany through the Red Cross via Lisbon and Geneva. Close of the war should ease shipping conditions, and export of dried and dehydrated products no doubt will decline, at least proportionately with relation to increasing exports of the raw fruit.

SUMMARY AND CONCLUSIONS

Brazil, in 1940, was probably the world's greatest banana producer and exported more of the fruit than any other country in the world. However, in contrast to the banana trade of Middle America which features the Gros Michel, a species of *Musa Sapientum*, Brazilian plantations export Nanica, a type belonging to *Musa Cavendishii*. Nanica is a shorter plant with smaller fruit, more disease resistant, and less susceptible to wind damage than the Gros Michel. Export from the lowlands around Santos, the major producing area, to Argentina, the largest importer, dropped off sharply during war years. There seems no reason to doubt, however that with more shipping facilities available, banana export will resume its pre-war status. In fact, it may exceed pre-war figures, for large areas are available for increased production, provided an expanding market lends encouragement.

THE CENTRAL VALLEY PROJECT: 1947

Elizabeth Eiselen

THE Central Valley Project is the ambitious but controversial program being undertaken by the Bureau of Reclamation for completely planned use of the water resources of the Central Valley of California (Figure 1). Unlike most valley projects, CVP is confined to one state, and that a state which ranks as one of the most prosperous in our country. Nevertheless, the project is of major significance because continuation of California's prosperity depends in large measure on wise use of water which drains into the Central Valley, especially that of Sacramento and San Joaquin rivers and their tributaries. The problems arise out of conflict of federal policies and private interests within an already developed region.

In spite of the relatively small area involved, the project is a complicated one. Just how complicated is best learned from examination of Figures 2, 3, and 4, which show plans of the Bureau of Reclamation for CVP. Like most work of the Bureau, this is a multiple-purpose project. Within the Central Valley—approximately 500 miles long and averaging 50 miles in width—exist most of the problems associated with water conservation; that is, wise use of water in irrigation, flood control, hydro-electric power, recreation, and domestic and industrial water supply. It is with all these that CVP is concerned.

The water problems of California and proposals for their solution are not of recent origin. The Central Valley Project takes on significance because it is most recent and comprehensive of the many plans which have been prepared for the Central Valley by local, state, and federal governments since California became a state in 1850. CVP was officially approved by the people of California in 1933 as a state project, provided the Federal Government would give financial and engineering aid. In 1935, the Bureau of Reclamation became actively interested, and on December 2, 1935, CVP was officially adopted as a project of the Bureau. It was not until 1937, however, that the first permanent construction could be started. Therefore, it seems appropriate in 1947, end of the first decade of constructional work, to examine the progress, problems, and plans of the Bureau for the Central Valley Project.

As originally planned, the first work of the Bureau of Reclamation was to be the construction of three dams: Shasta and Keswick on the upper Sacramento and Friant on the upper San Joaquin (Figure 2). Shasta and Friant dams, begun in 1938 and 1939 respectively, and essentially completed by 1944, rank among the five largest concrete dams in the world. The resulting Shasta and Millerton lakes are already functioning to regulate flow of water for irrigation, flood control, and river navigation as well as increasing recreational resources of California. Shasta has also a power plant which began generating electricity in 1944.

Work on the dams and related features was slowed by World War II. Although Shasta and Friant dams were completed, construction of Keswick Dam, begun in August of 1941, was temporarily abandoned. Work has been

resumed. When finally completed, it is to have a 75,000 kilowatt power plant and its reservoir is to aid in a salmon salvage program on the Sacramento River. In addition to delay on Keswick Dam, only two of the five turbines for Shasta's 375,000 kilowatt power plant were installed (Figure 5). The War Production Board halted manufacture of one turbine, and the two remaining turbines were loaned "for the duration" directly from the factory to the Grand Coulee power plant. The latter were being dismantled in the fall of 1946 for shipment to their intended location at Shasta. The Bureau hopes to have all

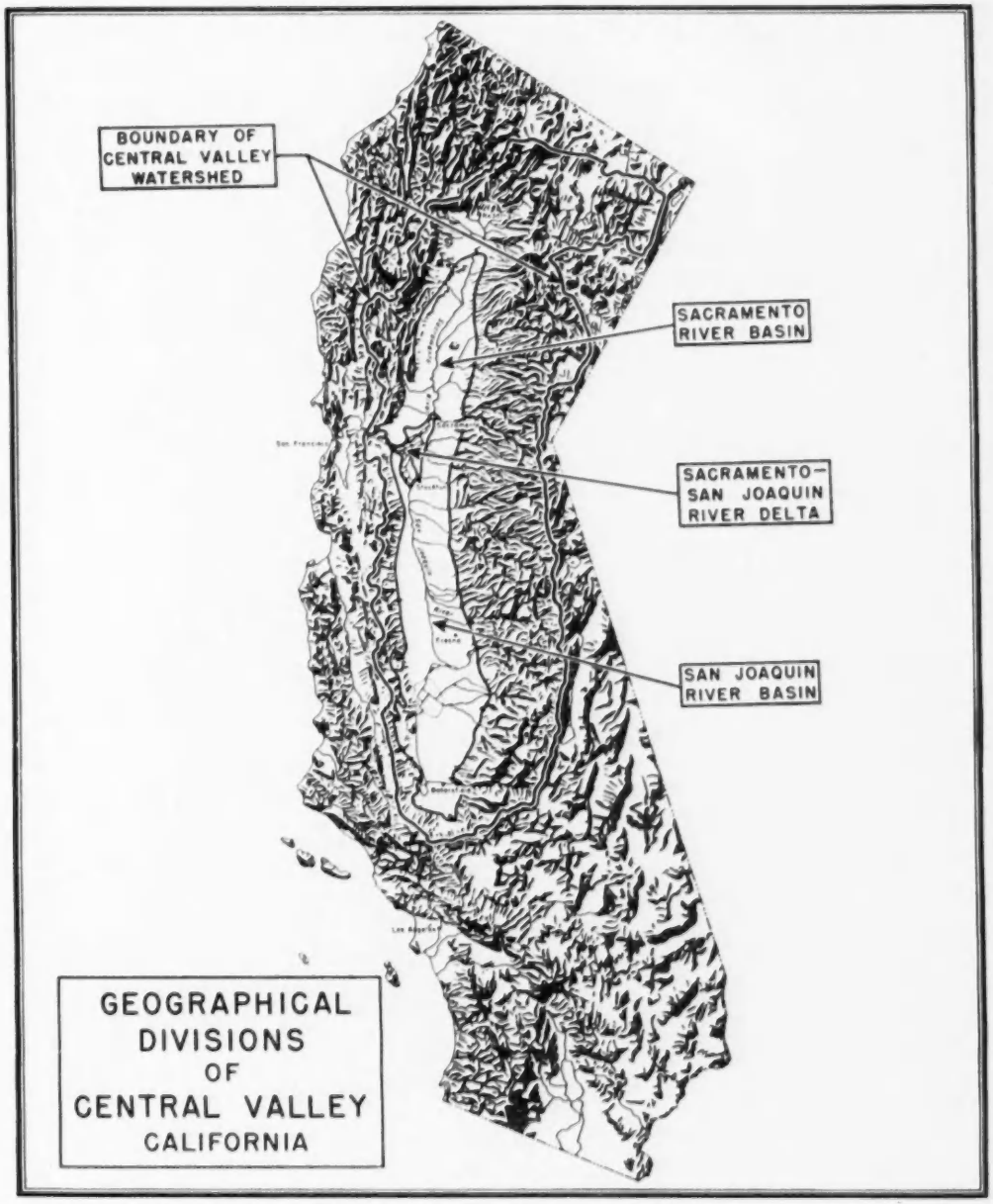
BOUNDARY OF CENTRAL VALLEY WATERSHED
SACRAMENTO RIVER BASIN
SACRAMENTO–SAN JOAQUIN RIVER DELTA
SAN JOAQUIN RIVER BASIN
GEOGRAPHICAL DIVISIONS OF CENTRAL VALLEY CALIFORNIA

FIGURE 1.—Geographical Divisions of Central Valley, California. (Courtesy of Bureau of Reclamation.)

five turbines in place by December, 1947.

Nor did Congress appropriate money during the war for transmission lines. A hundred mile line was erected from Shasta south to Oroville, the funds for it coming from savings made elsewhere on the project, but distribution of electricity has had to be made through sale of power to the Pacific Gas and Electric Company. It was not until late in 1946 that Congress authorized extension of the Shasta-Oroville line and then only for fifty-six miles.

Included also in the initial plans for CVP is construction of several hundred

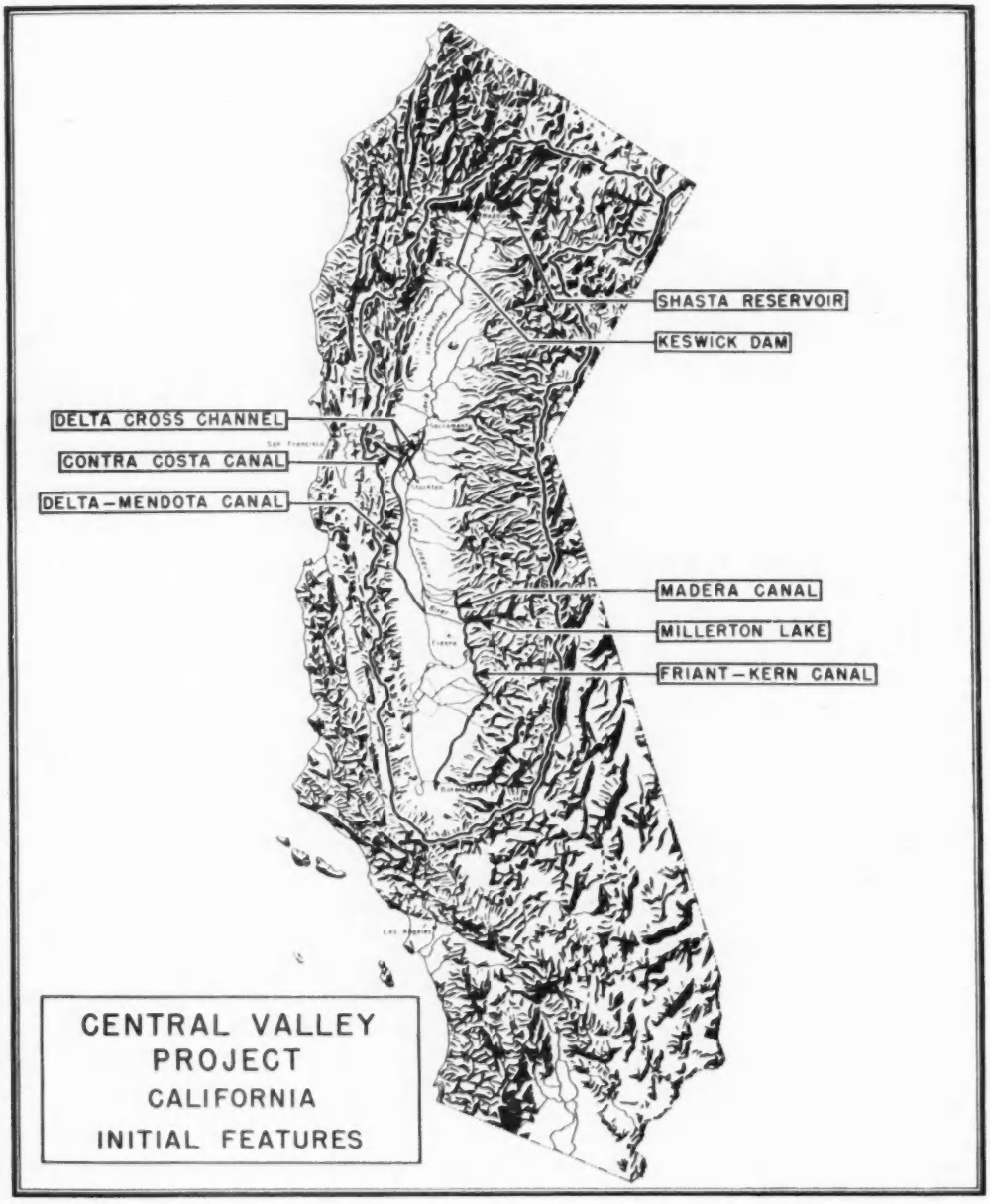

FIGURE 2.—Initial Features of the Central Valley Project. (Courtesy of Bureau of Reclamation.)

miles of canal to distribute water to the Sacramento-San Joaquin Delta for salinity control, to carry domestic and industrial water to cities of the same region, and to distribute water for irrigation wherever needed in the Central Valley. Need for such wholesale redistribution of water is related to southward decrease of precipitation in the Valley from an annual average of 38 inches in Redding, below Shasta Dam, to approximately 14 inches in the delta area and 6 inches in Bakersfield. Thus Sacramento Valley normally has more water than it needs and Sacramento-San Joaquin Delta and San Joaquin Valley have less.

Three primary canals are called for to distribute surplus water from the

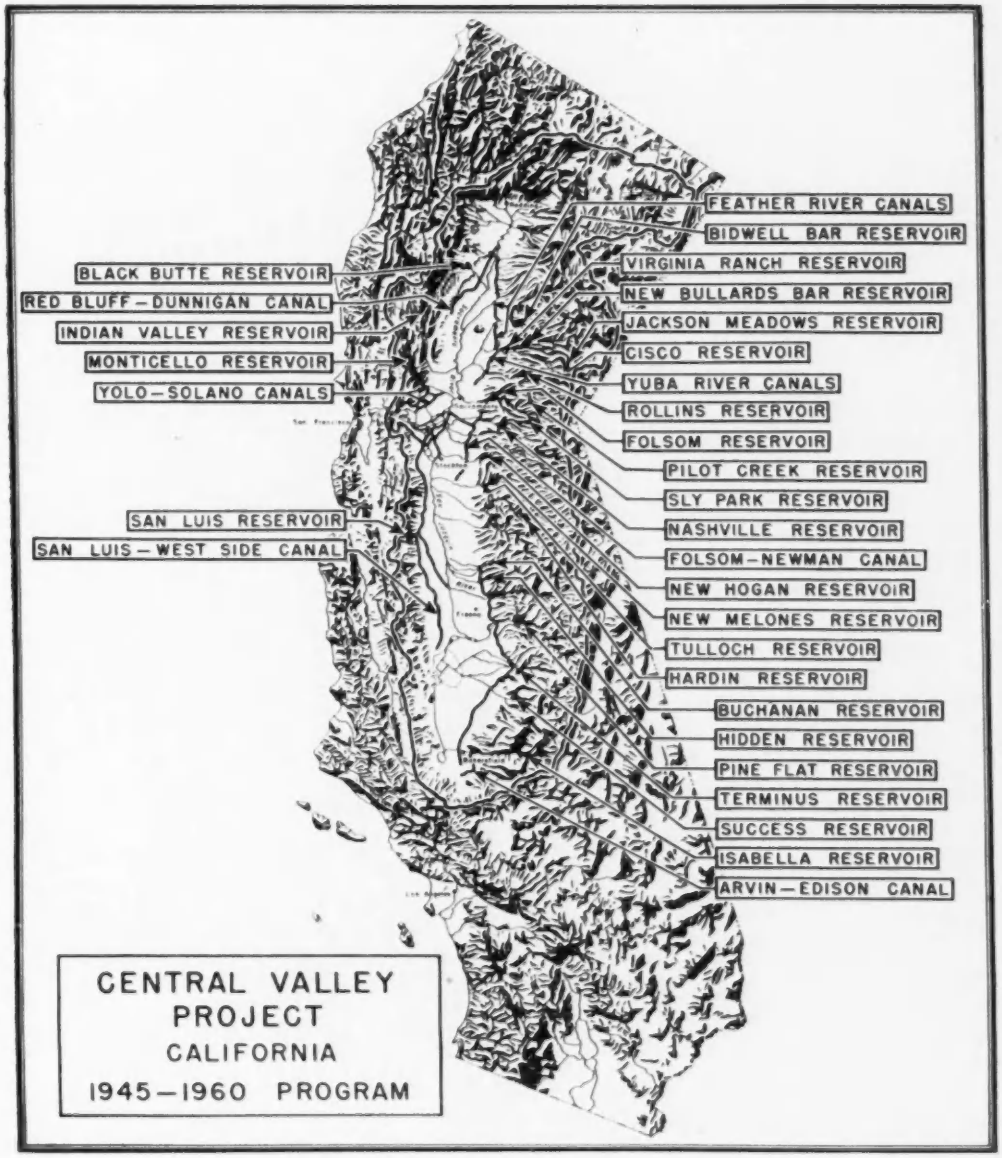

FIGURE 3.—1945–1960 Program of the Central Valley Project. (Courtesy of Bureau of Reclamation.)

Sacramento River to the delta and the lower San Joaquin Valley: Delta Cross Channel, Delta-Mendota Canal, and Contra Costa Canal (Figure 2). Only the Delta Cross Channel is still in the planning stage; the others are under construction, the latter nearing completion. By making use at least in part of natural channelways in the upper delta, the Delta Cross Channel will be the link between the regions (Figure 6). Some Sacramento River water will be pumped from the Delta Cross Channel into the Delta-Mendota Canal for distribution southward. Remaining water will enter various channels of the delta

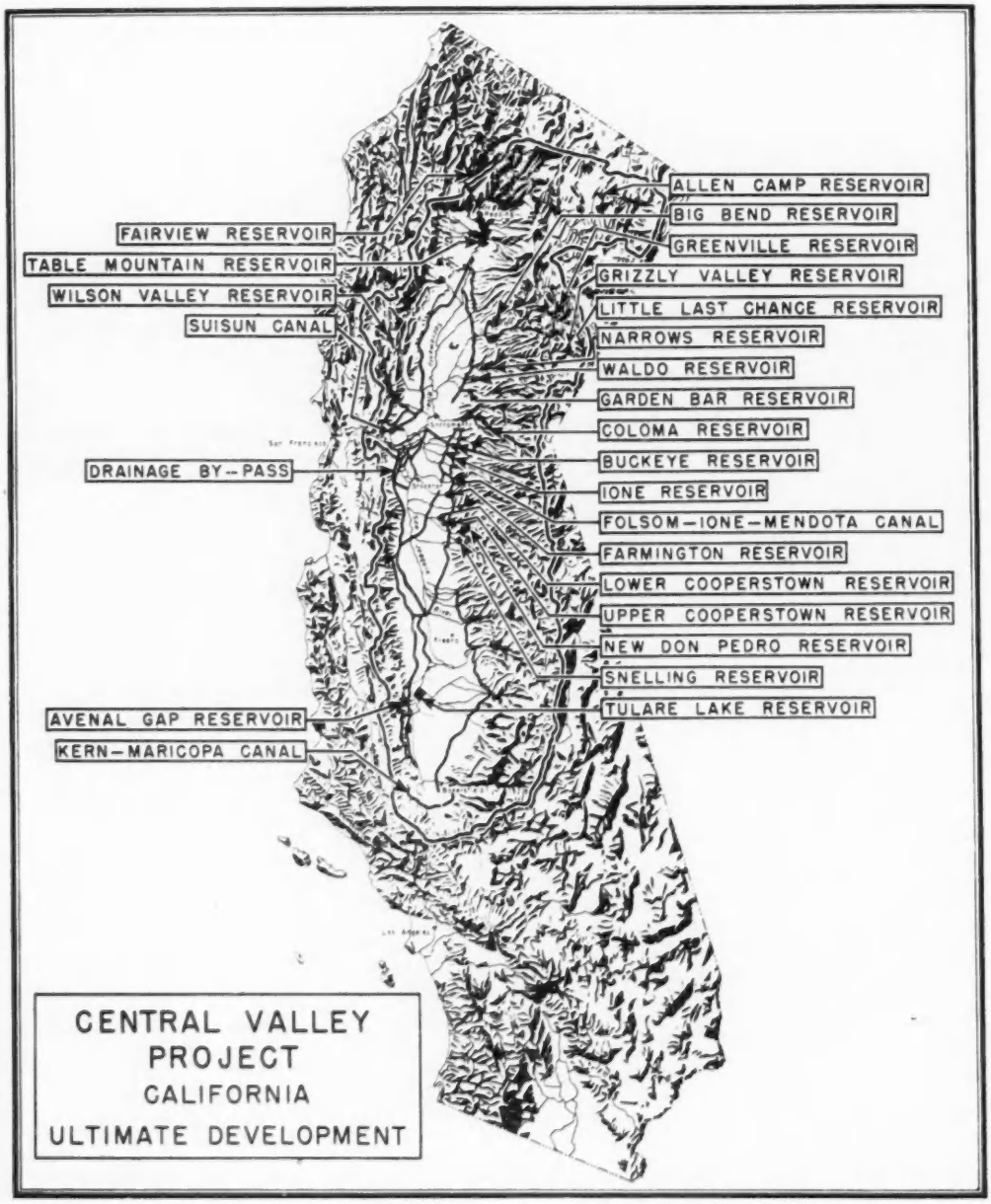

FIGURE 4.—Ultimate (Post-1960) Development of the Central Valley Project. (Courtesy of Bureau of Reclamation.)

to stop salt water intrusion from San Francisco Bay. From such natural channels water is already entering Contra Costa Canal to be carried westward to aid in salinity control as well as to supply needs of expanding industries and cities on the lower delta. Need for salinity control is particularly urgent, because unwise pumping of underground water has resulted in salt water seepage into fertile delta soils. The Bureau estimates that 360,000 acres of delta land must have such protection if they are to remain productive.

The Delta-Mendota Canal will be one of the most important features of the Central Valley Project, for by emptying Sacramento River water into the San Joaquin it will make possible diversion of San Joaquin water from Millerton Lake into the arid southern portion of the Central Valley (Figure 2). Very few rivers drain into the valley south of Fresno, yet here are thousands of acres of flat, fertile land needing only water to be productive. To bring this about, water will be pumped over a hundred miles southward through Delta-Mendota Canal to Mendota where Sacramento water will enter the channel of the San Joaquin. Thus lower San Joaquin River will have a substitute supply of water for irrigation as well as for maintenance of navigable depth for ocean-going vessels between Stockton and the Bay.

FIGURE 5.—Shasta Power Plant viewed from top of Shasta Dam in July, 1946. The two complete and three incomplete penstocks may be seen to the right.

The Madera and Friant-Kern canals are to carry water stored in Millerton Lake to irrigable lands of the southern San Joaquin Valley (Figure 2). Madera Canal, in service since June, 1944, extends northward for 36 miles, whereas Friant-Kern Canal (Figure 7) is being dug southward for 160 miles. The Bureau of Reclamation estimates that the canals will furnish new water supply to more than a million acres of land, particularly helpful from Fresno southward where thousands of acres of land once devoted to crops, vineyards, or orchards have had to be abandoned in recent years because of diminishing supplies of underground water. Other thousands of acres never have had sufficient water from any source for irrigation.

The Central Valley Project will not be finished with completion of the initial dams and canals. If engineers of the Bureau of Reclamation have their way, the destiny of every drop of water within the Central Valley will be controlled. Figures 3 and 4 showing the hoped-for 1945–1960 program and the projected post–1960 development are evidence of this. Dams with multiple-purpose reservoirs are planned for major and many minor tributaries of the Sacramento and San Joaquin rivers. More canals will be needed to distribute the water. To them, of course, must be added hundreds of miles of canals and dams, such as Hetch Hetchy, which were constructed before CVP came into existence.

In November, 1945, the Bureau of Reclamation completed a report entitled "Comprehensive Plan for Water Resources Development—Central Valley Basin California." A mimeographed summary of the report prepared by the Bureau states that planned facilities

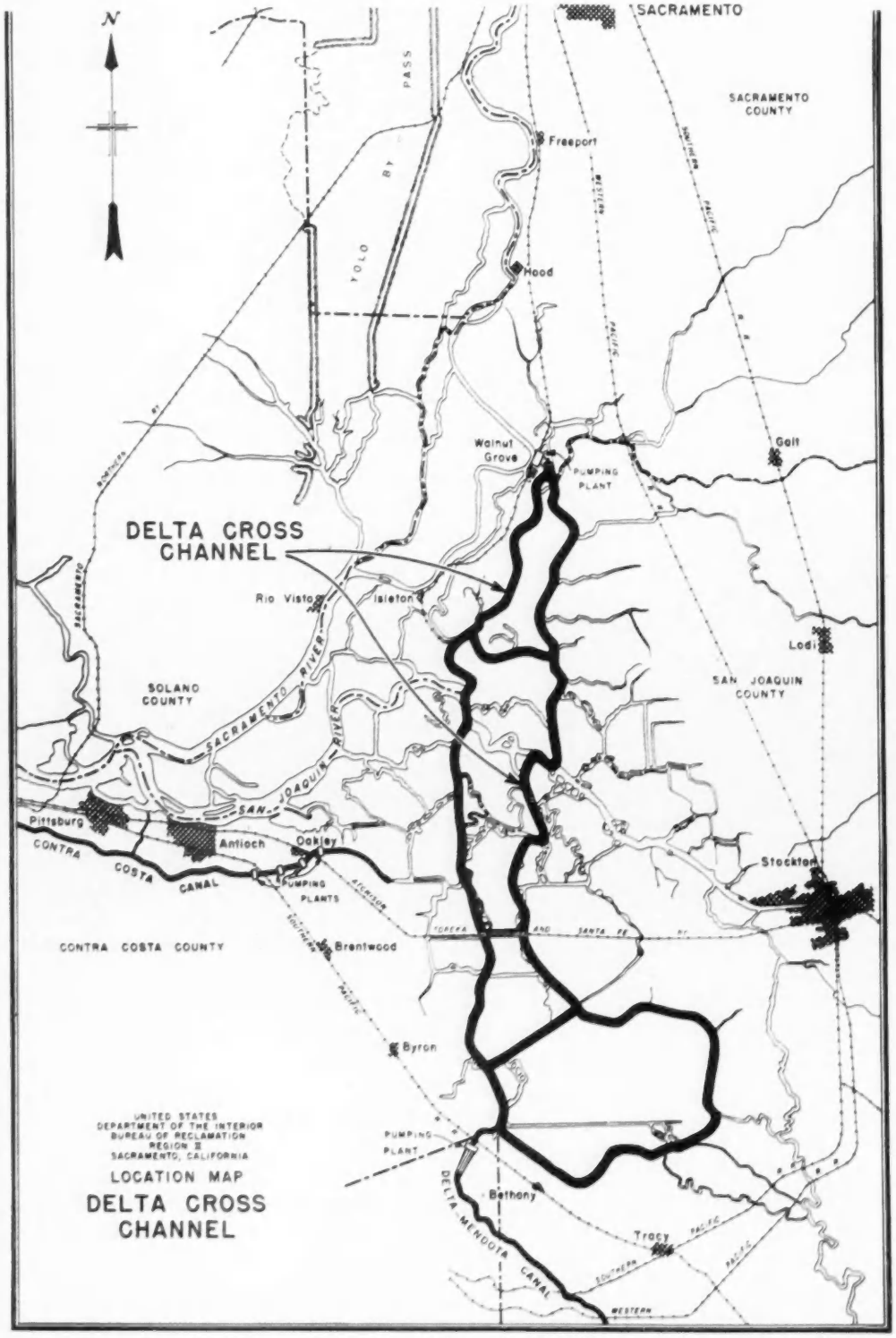

FIGURE 6.—Location Map of Delta Cross Channel. The Contra Costa and Delta-Mendota canals are located in the southwestern and southern sections of the map respectively. (Courtesy of Bureau of Reclamation.)

would ultimately make water available for:

(a) Nearly 2,000,000 acres of land now irrigated from inadequate ground-water supplies and about 400,000 acres which suffer damaging shortages in occasional dry years.

(b) 360,000 acres of land in the Sacramento-San Joaquin Delta needing protection from detrimental intrusions of salt water from San Francisco Bay.

(c) 3,040,000 acres of land not now irrigated.

(d) Municipal and miscellaneous purposes within the basin, including use by cities, towns, industries, military areas, farmsteads, duck clubs, and game refuges to the extent of 300,000 acre-feet of water annually.

(e) The generation, in conjunction with supplementary fuel-electric plants, of 8.1 billion kilowatt-hours of electric energy annually.

In addition, the multiple-purpose reservoirs of the comprehensive plan, supplemented by certain levees, channel improvements, and related facilities proposed by the Corps of Engineers, U. S. War Department, would eliminate most of the present periodic agricultural and urban flood damage in the Central Valley.

Although much remains to be done before even initial engineering works are completed, the Central Valley Project already is earning money. In *The Reclamation Era* for August, 1946, the Bureau of Reclamation reports the following income for the 1945–46 fiscal year:

Power Sales	$3,678,224
Line Rental	75,000
Lease of Grazing Lands	3,421
Miscellaneous (including rental of buildings)	100,750
Water Sales	232,807
	$4,090,202

The Bureau further explains the income in the following paragraphs:

"Almost all the power distributed was sold wholesale, under a temporary wartime contract, to the Pacific Gas and Electric Company at Shasta Substation near Redding, and at Oroville. Small additional amounts were used by the construction company at the dam itself, at pumping stations on the Contra Costa Canal, and at an experimental steel plant at Shasta Dam where the Bureau of Mines is developing standard steel and new alloys from California and Oregon iron, manganese, and chromium.

"Largest single purchaser of water has been the Contra Costa County Water District, which paid the Bureau $40,000 last year. This district was the first organization in the State to get CVP benefits, when it contracted for the output of the Contra Costa Canal just after the main canal was finished in 1940. The canal now waters farm lands, and supplies municipal water in the area around Martinez, Antioch, and Pittsburg, on upper San Francisco Bay, and supplies industrial water to the big Columbia Steel and Shell Oil plants nearby."

FIGURE 7.—Looking west from Friant Dam in July, 1946. The Friant-Kern Canal is under construction in the foreground. The San Joaquin River is barely visible among the trees in the upper right hand portion of the landscape.

In the meantime, the Central Valley Project is developing into a controversial subject within the state. The difficulty is two-fold. First there is the

problem associated with intrusion of federal power projects into the domain of private utilities; in other words, public versus private distribution of electricity. The second problem results from the fact that CVP, unlike most Bureau of Reclamation projects, is designed to maintain or increase production on lands already in private ownership, rather than opening of public lands to settlement.

It has always been intended that sale of electricity would help to repay the cost of CVP. In line with the policy, the Bureau of Reclamation would like to sell power directly to consumers, with preference being given by reclamation law to municipalities. The Bureau is handicapped, however, by refusal of Congress to appropriate funds for necessary power lines. Just as the people of California are in disagreement on handling the power, so are the House and Senate. Again quoting from *The Reclamation Era* for August, 1946:

> "The Central Valley Project appropriation as a whole was reduced from $25,000,000 included in the President's budget message to $10,840,120 in the House, and was restored on the floor of the Senate to the full amount requested. But in conference a compromise was worked out at $12,685,622, about half of the budget estimate. The power lines which would traverse the west side of the Sacramento Valley to bring Shasta Dam power to load centers in the Delta region are the vital link which can bring low-cost public power to cities and coöperatives in California. Officials of the Pacific Gas and Electric Co. opposed these lines. Bureau officials defended them. The House virtually eliminated the lines. The Senate restored them. In conference they were again curtailed. The Bureau may now find itself with only one customer bidding for its Central Valley power, although this power might have been delivered to the municipalities and coöperatives of California by their government at rates which excluded profit to the private power company. On the Central Valley Project a primary objective of the transmission system is to carry power for irrigation project pumping purposes from Shasta and Keswick Dams to the load centers in the Delta region."

Thus the Pacific Gas and Electric Company remains the only agency with available power lines, an arrangement which the latter is exerting pressure to continue. Under this condition, not only must California's consumers purchase CVP power through the private company, but CVP will be placed in the position of having to buy back its own power for its needs beyond range of the short extension of the Shasta-Oroville power line.

Of even greater importance to the future of CVP and farmers of the Central Valley is the law which limits sale of Bureau of Reclamation water to farms of less than 160 acres in size. The idea back of this was desire to help the many rather than the few, that federal aid should be spread out to encourage the small farmer rather than the large land owner. This was all right in case of public lands to be developed as result of reclamation work. In California, however, much of the land has long been in private hands.

From the 1940 United States Census statistics which use 180 acres rather than 160 acres as a division figure, it is obvious that a considerable proportion of landowners in the Central Valley will not be eligible for water. In the twenty-one counties all or part of which lie within the Central Valley there are 49,000 farms smaller than 180 acres. However, there are also approximately 9,500 farms too large to receive water from CVP. Of even greater significance is the amount of land involved, for only two million acres lie in farms under 180 acres in area, as opposed to almost eleven million acres in larger farms. Thus over 85 per cent of the land in farms would not be permitted water under present reclamation laws. Even California's community property law which permits husband and wife to purchase water for 320 acres does not solve the problem. For example, heavily irrigated San Joaquin County on the

lower San Joaquin River has 308 farms over 500 acres in size. They total approximately 411,000 acres, or almost 55 per cent of total land in farms in the county.

The problem, however, is not so simple as it might seem. Some California farm organizations are fighting to break up their large competitors. On the other hand, many of the largest farms are in the southern part of the Central Valley which is most in need of additional supplies of water. Some of these "farms" are the large holdings of companies such as the Kern County Land Company which owns several thousand acres of land near Bakersfield. Others are land holdings which have been handed down in families since the first settlement of the state. Naturally neither group wants to subdivide its properties; but if they are forced to do so, value of land will be greatly increased by prospect of CVP water, which also irks small land holders who seem destined to be dissatisfied whatever happens.

Tied into the whole controversy and on the side of large landowners in resisting the law is another objective of CVP; that is, to restore as much as possible underground water which has been lost as a result of excessive drilling of wells plus diversion of mountain water before it sinks into alluvial fans. Obviously there is no way to keep farmers who are not eligible to purchase CVP irrigation water from tapping without fee the CVP underground supplies. As would be expected, this has increased the bitter feeling between those who believe that farms of more than 160 acres should be subdivided and those who argue that water should be made available to all who need it, regardless of size of land holding.

Various proposals have been made for solving the problem of power and water sale. Some Californians argue that the project should be taken out of federal control and returned to the state. Others would like to see the work transferred to the Army Engineers, thus avoiding limitations of the Reclamation Act and at the same time insuring nonrepayment of cost, a characteristic of most army projects. Moreover, the Army Engineers have never shown much interest in production of power, a fact which pleases private utilities.

While arguments continue in the press and verbally, the Bureau of Reclamation is going forward with the project as rapidly as federal appropriations and available materials permit. Whatever the future of the project may be, it is obvious that California already has profited from the decade of active construction. To the country as a whole it means that in still another river valley man is endeavoring to adapt himself most wisely to his environment.

(Thanks are due Regional Office II, Bureau of Reclamation, Sacramento, California, for aid in the preparation of this paper and for the accompanying maps.)

RECENT MARKET ORIENTATIONS OF THE AMERICAN DAIRY REGION

Loyal Durand, Jr.

THE major agricultural pattern of the United States has been more or less stationary areally for some time. Each of the major agricultural regions of the Mississippi drainage basin has expanded westward in the past with the influx of settlers, and has reached its western margin at or near the dry land border of the 100th meridian. Continued expansion, with increasing markets, has been accomplished by (1) intensification within the region itself, or (2) pushing beyond the steppe border into the drier areas. Thus the greatly increased milk, corn, and meat production of the past ten years has been largely due to increased production within the existing framework of the American Dairy Region and the American Corn Belt, while the Cotton Belt has expanded areally westward into the drier lands of southwestern Oklahoma and western Texas. The existence of the Hard Winter Wheat Belt at the western, drier, edge of the Long Summer Climate in Kansas and southwestern Nebraska, and of the Spring Wheat Belt at the western, drier, edge of the Short Summer Climate in the Dakotas has acted as a buffer to retard westward expansion of parts of the Corn Belt and of the Dairy Region. Consequently the areal limits of the two latter regions have been fairly well set for some time. Only the Minnesota portion of the Red River Valley has gained much increase of the dairy industry at the expense of wheat-growing.

The very large increase of milk production of recent years has been result of (1) greatly increased production in the American Dairy Region, and (2) increased dairy production elsewhere, particularly in portions of the Corn Belt such as the northern half of Iowa, and in parts of the South. The purpose of this paper is not to discuss the shifts, but rather to point out some recent market reorientations within the American Dairy Region itself, coincident upon (1) increased milk production within the area, and (2) greatly expanded market offered by urban areas elsewhere in the United States, and by overseas shipments of dairy products. World War II was a major factor in the reorientation, both by providing overseas markets through "Lend-Lease," "Overseas Relief," by feeding armies and civilian populations, and by increasing the American home market. The latter increase is apparently due both to increased incomes among the population and shortages of competing products, such as meats, as well as to other local factors. Fluid milk production in November 1946 was 115 per cent of the pre-War rate, and fluid milk consumption 126 per cent. In pre-War days the per capita milk consumption in the United States was 340 pounds a year. Today it is 430 pounds.

The American Dairy Region has been drawn on increasingly during the last decade for fluid milk and cream supplies for the eastern half of the United States. As the one major region of surplus milk production in the country it has now become a major supplier of fluid milk and cream to distant markets;

in this respect it has now assumed a position in American agriculture parallel to that of the Cotton Belt in surplus cotton production, or the Corn Belt in surplus corn and meat production. Thus, as the market expanded, there was and is but one main area for cities to turn to in order to obtain increased milk and cream supplies—the Dairy Region. Market reorientations as a result of these changes have been pronounced, and fluid supplies of milk and cream are now shipped widely round the nation.

The pattern prior to World War II, familiar to geographers and economists was (1) the surplus milk production of the Dairy Region was turned into manufactural products such as butter, cheese, condensed and evaporated milk, powdered milk, and casein, and (2) each American city outside of the Dairy Region drew its fluid milk supplies from a more or less circular umland about it, engaged in milk production for the adjacent city market. Cities near the border of the Dairy Region, as for example, Chicago and New York, reached northward to the region for their market milk supplies. The greatly increased demand, coupled with wartime shifts of population (further increasing the demand), made the markets of the second type above too large for the dairy production of their immediate environs. The result has been: (1) these cities have been forced to draw on the main Dairy Region, often hundreds of miles distant, for portions of their daily supplies; (2) local milk production has increased somewhat; (3) milk distributors and health departments have engaged in frantic searches for new near-by sources of supply, and have attempted to interest local farmers in milk production; and (4) health regulations, in some instances, have been relaxed in order to admit nearby milk to the market. Examples can be given of all of the four types of urgent measures listed above: the maps illustrate cases of the first type; numerous instances of the second are available; health commissioners have made personal tours of farms in their vicinity to awaken an interest in dairying, as at Boulder, Colorado; and many temporary entry permits have been issued by other cities.

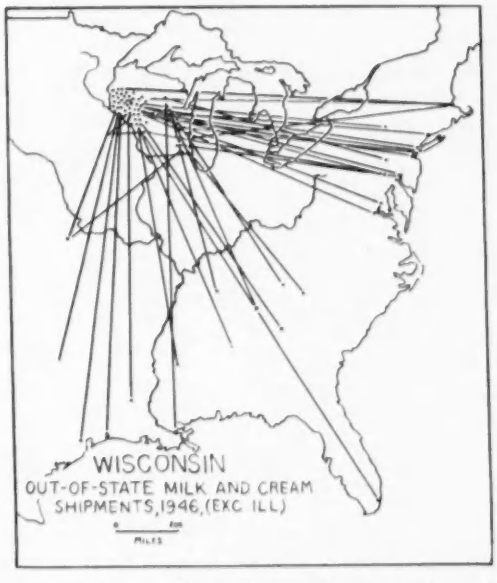

FIGURE 1.—Wisconsin out-of-state milk and cream shipments, 1946 (excluding shipments to Illinois). Dallas and Houston, Texas, are the points farthest southwest, Miami farthest south, Asheville, North Carolina, farthest southeast, and Boston farthest east.

The result of the war-born demand and the shortage of local supplies has been that cities all over the eastern half of the United States now reach to the Dairy Region of the Short Summer Climate for a portion of their supplies of fluid milk, fluid cream, and plastic cream. Milk is shipped hundreds of miles as fluid milk in railroad tank cars. It is also skimmed at the source region. The skim milk with its normal 9 per cent of serum solids, is condensed to 30 per cent serum solids, and shipped in fluid form as "condensed skim." The cream, separated from the milk, is concentrated to about 40 per cent fat, the

consistency of a whipping cream. These products are shipped to the market in the same tank car. At the market, water is added to "dilute" the product back to normal, the skim milk and cream are mixed together, and the dealer sells the resulting product as "recombined milk" or "reconstituted milk." The removal of the water element from the original milk saves the cost of transportation charges. In addition, concentrated cream in tank cars or cans, or in a more highly concentrated jelly-like mass known as plastic cream, moves a thousand or more miles to market. The statement that "bulky, perishable products, such as milk and cream, are produced close to market" is no longer strictly applicable. Some southern cities, during the year past, have been receiving as much as 55 per cent of their fluid milk supplies from localities as far distant as Wisconsin.

Other cities have supplemented their milk supplies with powdered milk wherever this practice has been allowed by the local Board of Health. Even this, however, involves purchase of concentrated cream, the milk sold in bottles being a combination of cream, milk powder, and local water.

MAJOR SOURCE REGIONS

The western, or manufactural portion of the American Dairy Region is the main source region, though by no means the only one, for city milk supplies for distant markets (Figure 1). This is a natural result of the general subdivision of the Dairy Region, due to market access, into (1) a fluid milk-producing area for city markets from Lake Michigan eastward to the Atlantic, and (2) a manufactural milk-producing area, excepting for the Chicago-Milwaukee region, west of Lake Michigan—the portion of the region farthest removed from large urban markets. Consequently, when distant cities were forced to reach to the Dairy Region for milk and cream, they of necessity had to tap the supplies of the manufactural portion, compete with existing cheese factories, creameries, and condenseries for milk supplies, and divert part of the milk formerly destined for manufacture to their local milk sheds. The result has been that many regions formerly marketing milk at cheese factories, cream-

FIGURE 2.—Location of dairy plants shipping milk and cream outside of Wisconsin, 1946 (excluding plants shipping to Chicago).

eries, condenseries, or powdered milk plants have now become portions of the milk shed of a city several hundred, or even a thousand, miles distant. Within the area thus tapped cheese factories and creameries have been forced to increase their price for milk in order to maintain their supplies, or have themselves become "receiving stations" for the distant city, buying from their former farm patrons, but shipping to the city markets rather than manufacturing the product. The profession of "Dairy Engineering" or "Dairy Brokerage" has arisen, the names having been chosen by companies or middle men who engage to obtain the milk

supplies at source regions and forward the product to far-away city markets. Some of these companies have built modern receiving stations, central points at which they concentrate the receipts from outlying cheese factories and creameries, and from which they forward the materials to the dairy distributors of distant cities. Without elaborating further upon the general geographic and economic ramifications of these recent trends, it is obvious that past market patterns will have been upset, that condensed milk, butter, and cheese production will have been affected, and that many plants will have been withdrawn from manufactural production, or will have shifted seasonally or annually to a fluid milk market. How permanent these changes will be remains to be seen; the trend now is toward large multiple-purpose plants, able to manu-

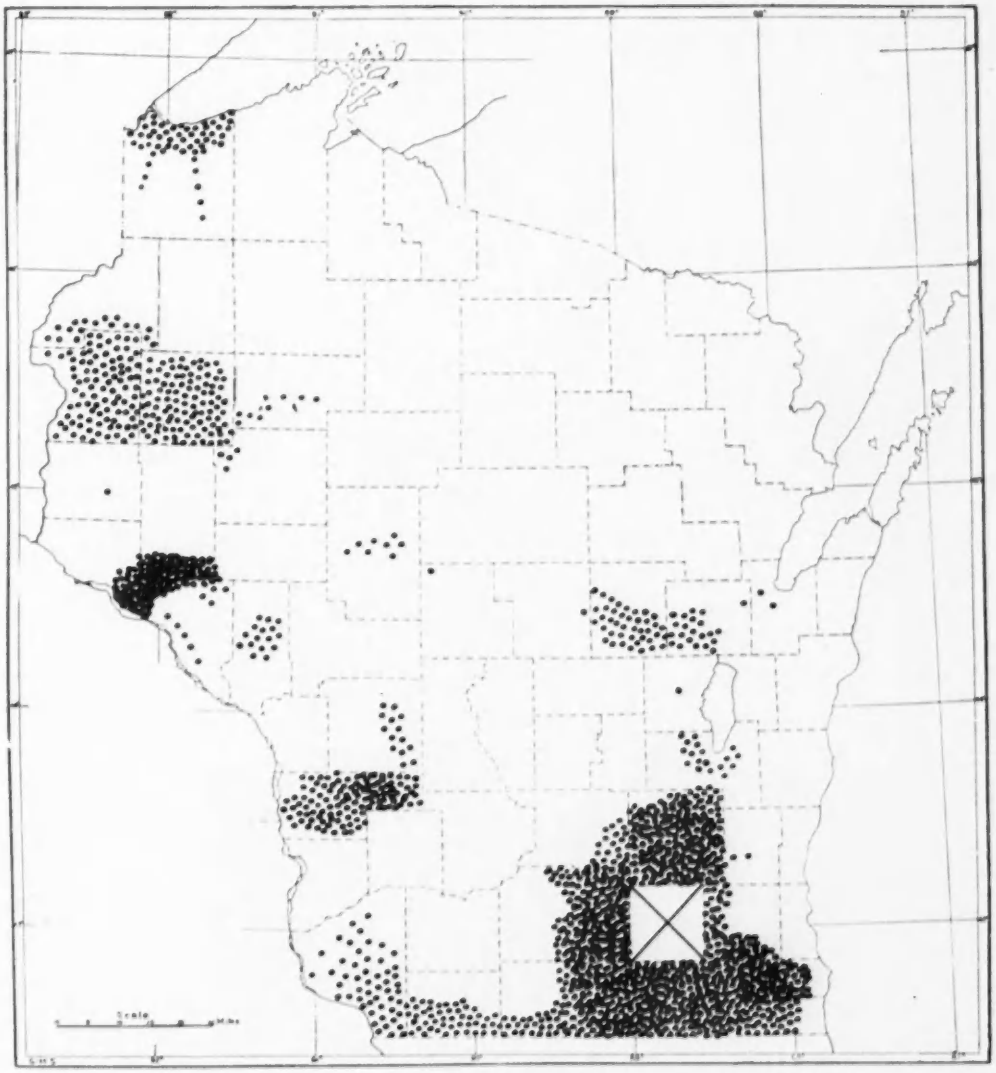

FIGURE 3.—*Increase* of out-of-state milk shipments to all markets, 1941 to 1945. Each dot represents 250,000 pounds *increase* in 1945 over 1941. The county marked with an X, while a leading county in out-of-state shipments, shipped less such milk in 1945 than in 1941.

facture butter, cheese, or ship fluid milk as the market demands.

WISCONSIN AS A SAMPLE OF A SOURCE REGION

Wisconsin illustrates the conditions within a source region of the American Dairy Region. As of 1946 fluid milk, condensed skim milk, cream, and plastic cream was being shipped from the state, and particularly from west-central and extreme northwestern Wisconsin, only 100 to 150 miles south of Lake Superior, to such distant points as Boston and Somerville, Mass.; Bridgeport and Hartford, Conn.; New York and Binghamton, N. Y.; Paterson and Newark, N. J.; Philadelphia, Harrisburg, Mechanicsburg, and Pottsville, Pa.; Washington, D. C.; Asheville, N. C.; Knoxville, Chattanooga, and Nashville, Tenn.; Atlanta, Ga.; Miami, Fla.; New Orleans,

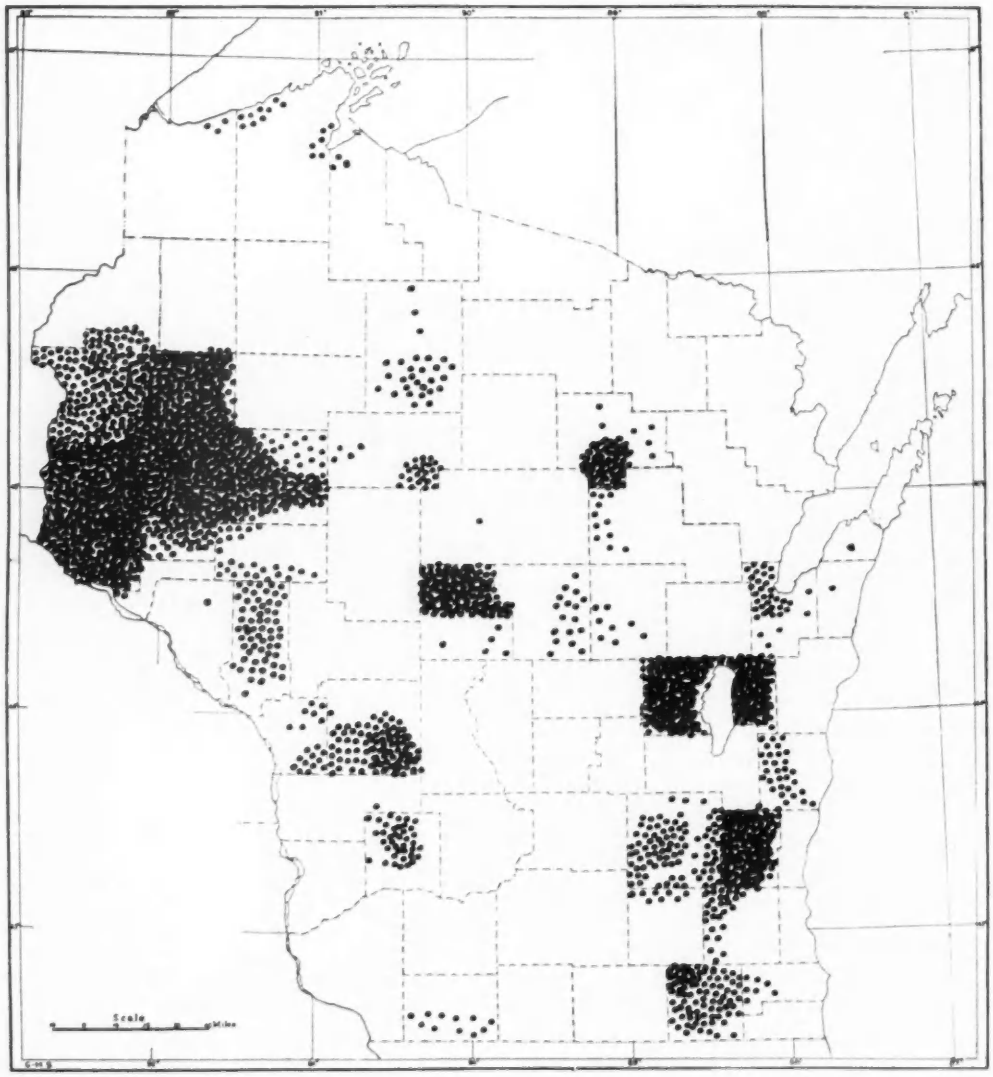

FIGURE 4.—*Increase* in out-of-state cream shipments, 1941 to 1945. Each dot represents 10,000 pounds of butterfat. Note the importance of Northwestern Wisconsin, the major source region for both the East and the South.

New Iberia, and Alexandria, La.; Houston, Dallas, and Port Arthur, Tex.; and to other markets located in the states of Michigan, Ohio, Indiana, Illinois, Minnesota, West Virginia, Virginia, Delaware, Alabama, Mississippi, and Kansas. One of the longest shipments in air-line miles is from Roberts, Wisconsin, 30 miles east of St. Paul, Minnesota, and 120 miles south of Lake Superior, to Miami, Florida, over 1500 miles. Several shipments of over 1000 air-line miles, but nearer 1500 by the land routeways, proceed from source regions in Barron County, Wisconsin, 80 miles south of Lake Superior, to Boston, Massachusetts.

Two regions in Wisconsin have entered the long-distance milk and cream shipping, though nearly all portions of the state provide some supplies (Figure 2). One region, the most important, is western and northwestern Wisconsin, a region devoted before the War primarily to the production of butter and of condensed milk. The second region is southeastern Wisconsin, an area that has always been a portion of the Chicago and Milwaukee milk shed. The supplies of milk for long-distance shipping from western and northwestern Wisconsin have been obtained by diversion of milk from creameries and condenseries. The supplies from southeastern Wisconsin have been obtained largely from increased farm milk production, permitting diversion of some surplus milk from its normal nearby city markets, and from cheese factory districts. The result of the market reorientation has been a marked decline in butter production in the western Wisconsin portion of the Tri-State Butter Area (western Wisconsin, southeastern Minnesota, northeastern Iowa) and an almost complete collapse of the Brick and Muenster cheese production of southeastern Wisconsin, though long distance shipments are not alone responsible for the plight of the latter industry. Negatively, it will be noted, but little long-distance milk originates in the well-defined cheese manufacturing regions of Wisconsin, and cheese production in the state has not only held its own, but has increased 41 per cent since 1938, and 8.1 per cent from 1944 to 1945, and at present the state manufactures more than half a billion pounds of cheese annually.

LOCATIONAL FACTORS IN THE WISCONSIN SOURCE REGIONS

The region of the northern portion of the Wisconsin Driftless Area and of northwestern glaciated Wisconsin entered the long-distance market milk and cream shipments as a result of a variety of factors (Figures 3 and 4). They are (1) partly accident, (2) partly the result of the existence of condenseries, creameries, and cream receiving stations in the area, (3) partly price factors, in that when the shipments originated prices were lower in these areas, 200 to 300 miles from the Milwaukee market and 300 to 450 miles from the Chicago market, and (4) largely due to the fact that less reorganization of the plants was necessary in order to enter the distant fluid milk and cream market. Dairy brokerage firms were able to tap these sources more successfully than others.

The creameries of western and northwestern Wisconsin receive separated cream from the farms. Condenseries receive whole milk. Consequently the creameries can purchase the additional skim milk and resell it to the condenseries for the production of condensed skim. They themselves concentrate the cream for shipment. The larger multiple-purpose dairy plants, located in nearly all of the moderate-sized towns, carry on both operations.

In contrast, a cheese factory receives whole milk for cheese manufacture and is equipped to handle it. Therefore cheese factories and cheese districts are more loathe to enter the long distance fluid market. Furthermore the cheese industry held up better under wartime conditions, except for Brick and Muenster cheese, and even increased. A large demand from the Armed Forces, and a large civilian demand for cheese as a meat substitute were undoubtedly factors.

MANUFACTURAL SHIFTS WITH MARKET REORIENTATIONS

The dairy manufactures of many sections of the Dairy Region have been War casualties. Some may be permanent losses; other are, without question, temporary changes. Butter production has been affected markedly in western and northwestern Wisconsin, and in the state as a whole, and Brick and Muenster cheese production has been affected in the southeast.

Butter production in Wisconsin, the third state in production (after Minnesota and Iowa), declined 41.8 per cent from 1938 through 1945. Between 1944 and 1945 there was a loss in one year of 12.1 per cent. Moreover the production in the first eight months of 1946 was only half of the production of the first eight months of 1945. The first uptrend was in September 1946. In 1945 total Wisconsin butter production was only slightly over half the 1938 production.

Brick and Muenster cheese production in Wisconsin (see Loyal Durand, Jr., The Cheese Region of Southeastern Wisconsin, ECONOMIC GEOGRAPHY, Vol. 15, No. 3, 1939, pp. 283–292) declined 58.2 per cent in the eight year period 1938 through 1945, and the remarkable total of 47.6 per cent in the one year, 1944 to 1945. In the latter year the entire state manufactured less Brick and Muenster cheese than was manufactured in the leading county (Dodge) in 1938. The decline was due in part to out-of-state shipments, in part to a wartime subsidy situation, and in part to the increased importance of Italian cheese manufacture, now second only to American cheese in Wisconsin, for Italian cheese production in the state has now surpassed Swiss cheese production.

OTHER REGIONAL SHIFTS

The cities of the Dairy Region, in order to protect their own milksheds and prevent diversion of local supplies to outside markets, have been forced to raise prices to farmers. Milk is now as expensive in some of the cities of leading dairy counties as in cities where a considerable cost of transportation is involved. Within the Dairy Region itself there is severe competition among receiving stations, creameries, cheese factories, and city distributors for the milk and cream supplies of the farmer. He does not seek a market; the market is seeking his product.

SHIFTS AT A MARKET CENTER

Knoxville, Tennessee, with a marketing center for milk and cream of nearly 300,000 persons, including the two nearby satellite cities of Alcoa and Oak Ridge, illustrates the conditions of long distance milk and cream shipments at the receiving end. Half a million gallons of milk were utilized at the Knoxville market in 1942, a million and a quarter gallons in 1943, well over three million in 1944, and over four million in 1945.

Powdered milk was utilized in Knoxville in the early stages of the milk shortage, when the local demand first exceeded the tributary local supply. Nearly 300,000 pounds of powder for

milk were used each of the first two years by the dairy distributors. Complaints about the situation, as well as Health Department wishes, forced a change to the importation of condensed skim and concentrated cream from Wisconsin. In 1942 only 50,000 gallons of this had been used. By 1944 the amount approached half a million gallons as the use of powdered milk dropped, and by 1945 practically touched one million gallons. Within the Knoxville corporate limits (excluding suburbs and satellites), 55 per cent of all milk sold during the winter of 1945–1946 was from Wisconsin. The total from Wisconsin dropped to 10 per cent in June 1946 as local pastures improved and output increased, but rose again to over 33 per cent by November 1946, and during the calendar year was running at a rate which will exceed the 1945 usage, and like the previous year, will average about 40 to 45 per cent.

Milk and cream reach Knoxville in tank cars carried on the daily passenger trains. Shipments leave Hartford, Antigo, and other points in Wisconsin daily, and are received daily. This movement to this one particular market is merely a small part of a daily transportation of milk and cream on the railroads and highways leading from the source regions to the consuming cities.

Knoxville, in common with other cities that have been forced to reach to the Dairy Region for surplus milk, has tried many methods, over and above price increases, to increase milk production in the local milkshed. As is the case in most localities, the efforts have been partially successful, and may become permanently so over a long enough period of time. It is not easy to turn tobacco, corn, or wheat farmers into dairymen. Farmers with existing herds can not always increase their size, as can often be done in the Dairy Region, because of the problem of feeds and feeding. Many farmers, especially in the South, hesitate to being tied down to a 365 day occupation, with milking morning and evening. Barns are small and inadequate to meet rigid specifications of local, state, and federal inspectors. Nevertheless, progress has been made. Without doubt, given enough time, the local milksheds will more nearly be able to meet the local demand. One dairy company in Knoxville has just completed the building of 24 barns for farmers, and set the farmers up in the dairy industry, with the expectation that production would begin by January 1, 1947:

The following item appeared on the front page of the *Knoxville Journal*, January 24, 1947:

"In an effort to stimulate milk production in the Knoxville area, the Agricultural Committee of the Knoxville Chamber of Commerce has called a meeting of producers, distributors, University of Tennessee dairy officials, and city health officials . . ."

"'Some $1,000,000 was spent last year for out-of-state milk and the meeting was called to find ways and means in aiding local farmers to produce more milk,' Fred A. Roberts, secretary-manager of the Chamber of Commerce, said.

"'The demand and uses for milk in this area have increased rapidly while the supply has remained virtually unchanged. The meeting is being held to try to build up the local supply to meet the demand.

"'Farmers who already have dairy herds will be asked to add more cows and other farmers will be asked to obtain milk producing herds,' Roberts added."

CONCLUSION

Knoxville is but one moderate-sized market in a market pattern that extends from the Missouri Valley to the Atlantic,

from Texas to Florida. This market multiplied many times, gives a small idea of the War-born reorientations in the dairy industry. Wisconsin is but one source region, though the most important, for an outflow of milk and cream from the Dairy Region to the cities of the eastern half of the United States.

Geographically marked shifts have occurred in the dairy industry. Many are directly related to the War. Others have been induced in part by dairy subsidies, by government payments for soil conservation, the planting of cover crops, coöperation with government fertilizer programs, and other factors. Dairy production has increased, yet the market has increased more rapidly. Market reorientations have occurred, both within the Dairy Region itself, and between the Region and outside areas. The shifts have affected most of us, as we well know. We may have been drinking fresh milk from northern Wisconsin, 1000 miles from our homes; we may have been trying to purchase a pound of butter; or we may merely have been wondering why geographical patterns have not remained stationary. Such, of course, is impossible in a dynamic world.

SOUTHEASTERN LITTORAL OF KOREA

Shannon McCune

SQUEEZED into a narrow irregular ribbon by the sea eastward and the mountain barrier westward, the Southeastern Littoral is a distinctive region of Korea. For convenience regional boundaries have been drawn along county lines, although it is appreciated that such boundaries denote transition zones. The five counties making up the region extend from 38° 50′ to 36° 40′ North and have a natural and historical homogeneity. Despite the unity, an artificial line, the 38° parallel, now divides the region into American and Russian zones of occupation. If such a division long endures, the economic and social unity of the region may be destroyed.

The Relief

The Southeastern Littoral is a series of valleys and foothills on the eastern flank of the Taepaek Range. The mountains rising abruptly from the littoral are not uniform in geologic structure. The northern part was a positive element of Archean metamorphics with granitic intrusions. Against this, sediments ranging from Carboniferous to Triassic age were deposited in a syncline to the south. The sediments were folded and faulted in late Mesozoic. The resulting highlands with west-south-west and east-north-east trend were then leveled by erosion. During the Miocene, however, the whole block was uplifted. The fault zone roughly parallels the present coast line. A few minor crustal movements have since elevated small patches of recent sediments.

The present relief of the region has been the result of erosion of the complex base by short streams of which the headwaters are actively cutting back into the mountain wall and reducing the spurs. Marked contrasts in relief forms arise from differences in basic rock material. Granite and some sedimen-

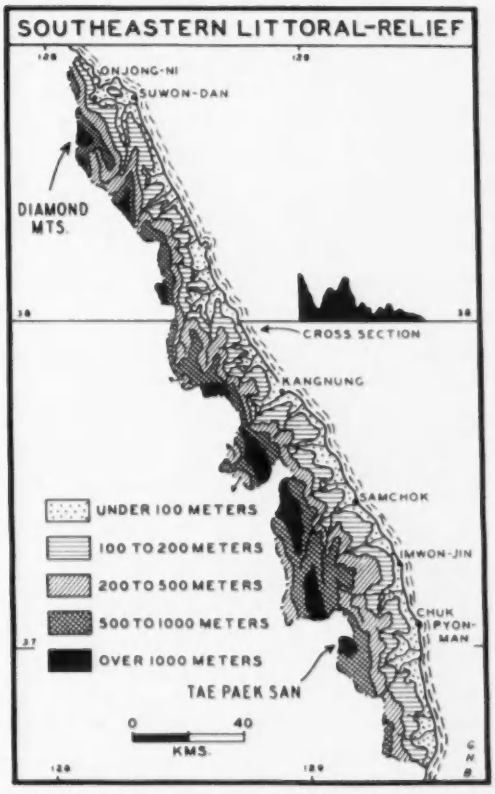

FIGURE 1.—General Relief Map of the Southeastern Littoral of Korea. This map only shows the main lineaments of this coastal region. The details of relief which are extremely important in the daily life of the people cannot be shown. The cross section along the 38° parallel is exaggerated two times horizontally and twenty times vertically. The map has been modified from the Map of Korea, Scale 1:1,000,000, Han-Yang Products Company, Seoul, Korea, 1938.

tary rocks are much less resistant and consequently are worn into rounded forms with severely-eroded hills and debris-clogged valleys. Metamorphics and older sedimentaries have angular details. In the northeast a small basaltic lava flow has distinct palisade structure. The Koumgang San, or Diamond Mountains, in the northwest, the most famous land forms in Korea, are the result of differential weathering of granitic and metamorphic rock. The precipitous slopes and myriad peaks afford scenes of beauty in any season. Along the littoral many streams, in some cases entrenched, have develope alluvial plains as they reach the sea. Material, wave-washed from the headlands, often blocks the bays with sand bars, behind which lagoons are formed.

The Sea of Japan to the west is also a formidable barrier, isolating the region. The water is deep and has small tidal range. Flowing from the south is the warm Tsushima Current, a branch of the Japan Current. It overrides the cool Liman Current coming from the north, although occasionally the cool water wells up to the surface along the coast.

THE CLIMATE

The marine influence makes the region climatically a part of southern Korea, although it is located in the east-central part of the peninsula. Because of modifying influence of the Sea of Japan on temperature, winter and summer contrasts are not so pronounced as they are in areas to the west. Mean January temperatures are below freezing, but are not below 27° F. Average summer month temperatures do not go above 78°. The chart for Kangnung, located in the center of the region, is representative of general conditions. Naturally, average annual temperatures are lower in the north, 51.8° at Suwon-dan, and higher in the south, 54.5° at Imwonjin and Samchok. The north has a slightly more severe winter. More pronounced is the variation with location away from water and with increased elevation. For example, average January temperatures at Onjong-ni, inland from Suwondan, but only 50 meters higher in elevation, are 2.7° colder; average August temperatures are 1.1° warmer. Highland climatic stations are lacking but vegetation and winter snowfall indicate colder temperatures with higher elevation.

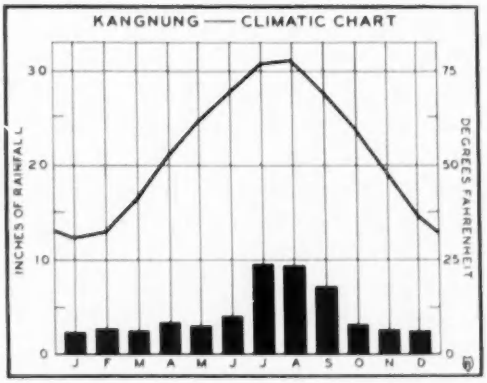

FIGURE 2.—Climatic Chart of Kangnung, Korea, 14.7 meters, 128° 54′, 37° 45′, average data for 1912-1937. Additional data derived from *Handbook for Daily Use, 1939*, Government-General of Tyosen, Meteorological Observatory, Zinsen, Tyosen, 1938, is as follows: Atmospheric pressure ranges from 30.2 inches in January to 29.74 inches in July; average maximum temperature is 83.8° in August; absolute maximum temperature was 99.3° on August 1, 1929; average minimum temperature is 22.3° in January; absolute minimum temperature was on January 13, 1915, -4.3°. Average relative humidity ranges from 54 per cent in January to 81 per cent in August. Rainy days range from six days in December and January to 15 days in July and August, yearly average is 114 rainy days. Clear days range from 13 days in December and January to two days in August. The average yearly rainfall is 50.8 inches. The cold season when temperatures below freezing occur starts on the average on November 15 and ends on April 3.

Other climatic elements reflect the maritime location of the region. Annual precipitation is quite heavy. There are greater amounts of rainfall in proximity to the mountain wall. Onjong-ni on the edge of the mountains has 64 inches

annual average rainfall; Chukpyon-man, a lighthouse station, has only 38 inches. There is the usual July and August maximum of rainfall due to the monsoon influence, convectional activity and cyclonic disturbances. The rainy season is continued into September when occasional typhoons bring heavy rainfall. The April secondary maximum is due to increased effectiveness of cyclonic storms crossing the peninsula from the west. The Southeastern Littoral also has significant percentages of winter precipitation, often in form of snow. Monsoonal air drifts containing moisture after their passage over relatively warm currents in the Sea of Japan are disturbed by passing cyclonic storms and precipitation follows.

THE HISTORY OF SETTLEMENT

Isolation of region from the rest of the peninsula, segregation of individual valleys, relatively equitable temperature regime and plentiful rainfall have all had important bearing on history of settlement of the Southeastern Littoral and make it a unique region in Korea. The early history of human occupance in the region is legendary. Peoples moving out of Central Asia in prehistoric times forced people in northern China and Manchuria to move into the Korean peninsula. Some of them migrated into southern Korea. Here, in isolated valleys, they built sedentary villages and introduced more advanced arts and customs to the primitive migratory folk, who had come in even earlier waves. Two thousand and more years ago the small Ye kingdom, with a capital at Kangnung, controlled the Littoral. According to Chinese accounts the people were simple and peaceful, living in rude mud and thatch houses. Hemp and cotton were used for clothing, and stars were observed to foretell famines. Though predominantly farmers, the people carried on some fishing and raised small ponies. In 107 B.C. the Chinese conquered all of northern Korea and the kingdom was absorbed into a large province containing most of central Korea. The people sent an annual tribute to China of grass-cloth, dried fruits and ponies. Later, as Chinese control relaxed, the Silla kingdom, set up in extreme southeastern Korea in 58 B.C., took the Littoral into its domain.

During the succeeding centuries Silla played little part in the struggles and wars which ravaged the northern part of Korea. Isolation afforded by the mountains protected the Littoral. The people withdrew from the immediate coastline and thus were hindered less

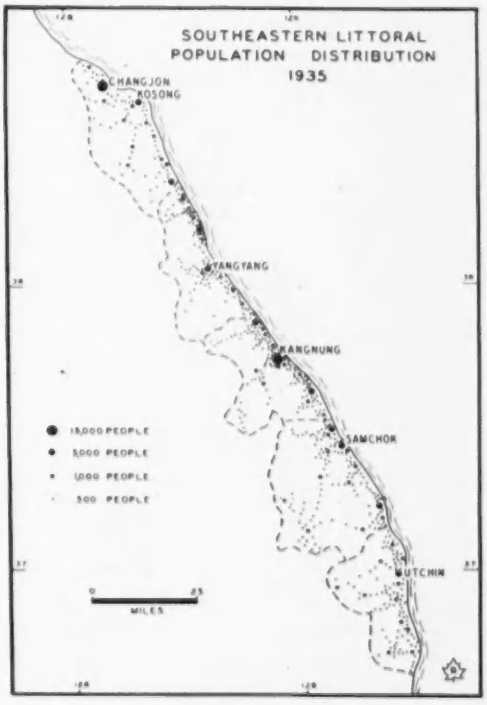

FIGURE 3.—Population Distribution of the Southeastern Littoral. This map is based on data for the 1935 census plotted on the Map of Korea, Scale 1:1,500,000 of the Government-General of Tyosen, with the aid of the Map of Kogen (Kangwon) Province, Scale 1:500,000, and scattered topographic sheets, Scale 1:50,000.

by raids of Japanese pirates. According to early records the Silla people lived in walled cities, produced silk, used domesticated oxen and horses, had metal money and carried on trade by means of fairs. Among items of tribute sent to China's Tang dynasty (618–906) by Silla, and presumably produced in part in the Littoral, were beautiful furs, rolls of grass-cloth, silk fabrics, inlaid boxes, mats in dragon patterns and fine mulberry bark paper. From Silla the Japanese received much of their early culture, particularly Buddhism which had become Silla's state religion in 372 A.D.

Though as time went on, Silla increased in power and space, it overreached itself and eventually was engulfed by a new kingdom which for the first time controlled all the Korean peninsula, and made its capital at Kaesong in 912. However in 1392 a new dynasty came into power and moved the capital to Seoul. With the political and economic center thus in central Korea, the Littoral probably declined in relative importance. An early census return reports that there were only 3,108 taxable families resident on the Littoral in 1425. In part because of its isolation the coastal area did not suffer too directly from the successive invasions of Korea by the Tartars, Mongols, Japanese and Manchus. These aggressions forced the Koreans to attempt to close their frontiers as tightly as possible to foreign influence and covetousness. In this hermit age the Littoral became even more self-sufficient and isolated. Though the 1789 census reported 16,843 taxable families, in 1868 only 14,554 families were reported. When Korea's hermit existence was terminated in 1876, the isolation was broken. After 1910 when the Japanese annexed Korea, great changes were effected in the life of the region.

THE LITTORAL UNDER THE JAPANESE, 1910–1930

During the next twenty years the Littoral changed in character quite decidedly. The transformation was due in part to the Japanese but also to the general trend in the world's economy as new techniques and products were developed. The land and sea resources of the Littoral no longer had only local markets and were, therefore, utilized more intensively and effectively, with the result that population increased so that by 1930 there were 364,715 persons living in the region. Of this number only a fraction—one to two per cent—were Japanese, engaged in government, commercial and fishing supervisory positions. Most of the Korean people were farmers. A little under half of the total population, 47.6 per cent, were reported in the 1930 census as gainfully employed; of these 81.5 per cent were farmers. The remainder were engaged in various occupations: commerce (5.6 per cent), manufacturing (4.3 per cent), fishing (3.3 per cent), government officials (1.3 per cent), other occupations (4 per cent).

AGRICULTURE

Hence, agriculture was the dominant function of the Littoral. However, only one-tenth of the land was used for crops, limited to the small plains and terraced or gently-sloping hill land, for the most part. Farm units were small. According to agricultural data for 1928, a representative year, there were 36,938 farm families. They each operated an average of 3.65 acres of cultivated land. The land was either paddy (44.5 per cent of the total) or dry fields (55.5 per cent). Paddy fields were on the valley floors or terraced hill slopes where water could be held and easily drained. Obviously within the Littoral there were con-

trasts in the relative amounts of irrigated land due to differences in climate and land form. In Samchok County which suffered much erosion, paddy fields made up only one fifth of the total cultivated land, for example.

Paddy land was used for rice, the staple food. In the Littoral seed beds were planted in the last weeks of April. Transplanting took place toward the end of May and harvest came in late October. The dominant type of rice seed, introduced by the Japanese, was Kokuryado, a high-yielding, slow-maturing variety. Rice was dependent upon rainfall for its water; irrigation systems with large catchment basins were not developed and thus in some years drought decreased the yields seriously. Kangnung County, in the center of the region, favored by the greatest extent of land adaptable to paddy fields and by the largest market, had the greatest production. As better irrigation facilities, higher yielding varieties of seed, cheap fertilizers, and more adequate transportation outlets were introduced, rice production and yields increased. In 1928 the yield was roughly 25 bushels of husked rice to the acre with highest yields in Kangnung County.

Double cropping was quite common in the Littoral, since winter temperatures were not too low. Crops were grown on both the paddy and the dry fields. Paddy fields were drained of standing water about a month before harvest. If they were not too waterlogged after the harvest, fields were prepared for winter crop by plowing and digging drainage trenches. In the Littoral the crop usually planted in paddy fields was barley, harvested in late spring and furnishing basic food for the farm family. However, most of winter crops were grown on dry fields.

Dry fields, making up over half of the total crop acreage, were of special importance in areas of small plains. Samchok County had over one-third of the dry fields in 1928. Most dry fields were located on the lower slopes of the valleys or on the bay mouth bars which were not suitable for paddy fields. A few "fire-fields," patches cleared by migratory squatters, were perched high on the steep mountain slopes. The common dry field crops were for food. Barley was grown in both summer and winter. Wheat, usually a winter crop, was cultivated on the drier fields. Beans and mulberry were sometimes grown in

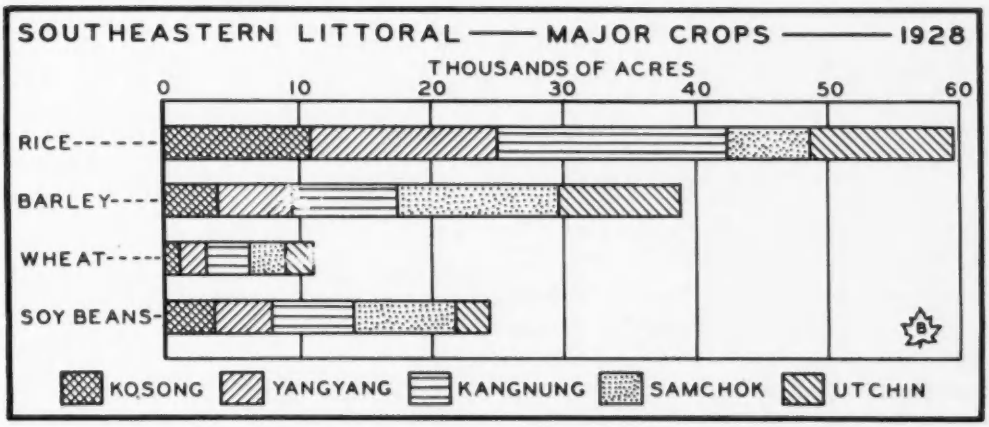

FIGURE 4.—Graph of the Major Crops of the Southeastern Littoral by Area in 1928. Data was obtained from the Annual Report of the Kogen Provincial Agricultural Experiment Station, 1930. The bars are divided according to the five counties; the one to the north being at the base of the graph.

borders around the rice fields. In many places beans were intertilled on fields with mulberry bushes. In mountain areas millet was grown. If the regular cereal crop failed owing to disease or drought, buckwheat was planted as a catch crop. Cereals of minor importance were grain sorghum, corn and oats. In addition to silk, indirectly derived from mulberry, farmers obtained textile material from cotton. Native varieties were predominant, although new American-type seeds were being introduced by the Japanese. Mourning cloth was made from hemp. Vegetable crops were of significance in the simple farm economy. Irish potatoes were grown in the north, and sweet potatoes in the south. "Kimchi," the hot pickle that makes the Korean meal complete, was made from turnips and cabbages, grown universally. In the north, apples and pears were introduced. Ripe persimmons, often grown through grafting, added red and orange color to the southern courtyards in the fall of the year.

FISHING AND FORESTRY

Although fishing was the full-time occupation of only one of thirty people, it was a distinct function of the Littoral, for many farmers engaged in it as seasonal or part-time occupation. Cold and warm waters meeting off the coast provided excellent fishing grounds. Small range of tides, and numerous inlets where boats could be beached, were additional favorable factors. In past centuries incursions of pirates, ignorance and fears of the Korean fishermen and small boats and poor equipment used kept fishing near shore. A transformation was wrought by introduction of modern methods by the Japanese. The fishing industry was becoming concentrated into a few well-sheltered ports along the coast; some of them were new towns. From such points launches, often powered with gasoline motors, went out with modern expensive nets and other equipment. With such equipment catches were large. Korean fishermen with clumsy sailing boats and facilities for close-shore fishing could not successfully compete. Fish were of many varieties. Unique among them were the grey whales, but they were soon killed off. Most of the catch embraced sardines and various food fish that could be salted and dried.

Another part-time occupation was forestry. The hillsides were originally covered with mixed coniferous and hardwood forests. However in past centuries many hills were denuded of their cover by cutting and ravages of an insect pest. Poor stands which were left in the more densely settled coastal areas supplied some of the demand for brush and firewood. Farm boys spent their days raking forest litter and breaking off branches. On the higher lands grew some good stands of red pine which were held in olden times as royal forests. These the Japanese controlled and preserved through stringent enforcement of cutting laws. They also embarked on a much needed program of reforestation, especially in the southern areas which were being badly eroded.

SETTLEMENT PATTERN

Villages, varying from a few to hundreds of homes, were the settlement units in the Littoral. A few exceptions were dispersed farmsteads and squatters' huts in the hill lands. Farming villages were situated up in the valleys, along the contact between hill and plain. Each village had a tree—usually a gnarled pine, about which the houses

were crowded. Often small shrines were located near the trees or at entrances to the villages. Such little fenced buildings had wooden lattice walls and heavy tile roofs overgrown with moss, protecting the memorial tablet. Larger towns, including county seats, had squares which were empty for four days and then teemed with life on the fifth day when the market was being held. Of the larger towns only Kangnung had more than local importance. Farming villages and towns were all set back from the sea, reflection of days when the inhabitants defended themselves from Japanese pirates. Fishing villages, some of them quite newly settled, differed in being located along shore, usually sheltered by a headland.

House types in the Littoral were slightly variant from those in other parts of Korea. Buildings were constructed with mud plastered on a lattice of stalks held up by wooden frames. Homes consisted usually of two small rooms with a kitchen at a lower level. Smoke from the kitchen fire, passing under and heating the floor of the home, rose from a chimney set two to five feet out from the eaves of the house. The gabled roofs were usually straw-thatched; criss-crossed ropes held the thatch in place. In many villages were one or two more pretentious homes, distinguished by their tile roofs. They were occupied by the local scholar or landlord. In some of the very isolated valleys, the homes reflected poverty and backward conditions by being covered with bark and stones, rather than with thatch. Around farm village, homesteads were walls of stone and mud, sometimes thatched. Homes in the wind-exposed fishing villages had higher walls about them, sometimes as high as the eaves. In newer fishing villages some houses were roofed with tin; in such places an occasional Japanese-type dwelling could be noted. Individual villages in the Littoral were quite isolated from each other. Farmers rarely ventured far outside their own valley. They exchanged their products at the periodic village fairs, held in each valley in a regular sequence. Most exported products from these valleys were carried by porters or cattle. There were some poor cart roads but the Japanese improved them, forcing the people to work on the roads as a tax. Boats plied along shore and carried some of the heavier goods. Ponies were major means of communication for those who did not walk. The most colorful sights were the bridal processions, with the bride in a decorated sedan chair surrounded by members of her family going to the groom's home for the ceremony and attendant feast.

THE LITTORAL AS A PART OF JAPAN'S WAR ECONOMY

During the decade from 1931 to 1941 Japan began to prepare for war. Though the Japanese primarily seized large areas of the continent—Manchuria and North China—and exploited the resources there to build an economic base, they did not neglect neighboring areas. The Littoral, though poor in war resources, was used more intensively. Great efforts were made to increase agricultural production. Stress was laid on development of more paddy fields and on introduction of better rice and cotton seed. However, the land had already been exploited almost to its limit and probably the increased food and fiber production was matched by the needs of the increased population. During the five years from 1930 to 1935 the population increased by one-eighth to 412,172 persons, a density of roughly 182 per square mile. Population distribution was quite similar to that of 1930 with most of the people living in small agricultural vil-

lages. However, there was growth of urban population in the fishing and industrial towns, a trend which continued in subsequent years, especially as new economic activities became more important.

The fishing industry became more specialized. The major catch was the plentiful sardines, though other food fish were caught and dried for movement out of the region. Sardines were dried in the sun, boiled for glycerine oil and pressed for fish meal fertilizer. Concentration of the industry into a few centers became more pronounced and control of the fishing industry was exclusively in hands of the Japanese.

Coal deposits in the Taepaek Range were exploited. One mine, fifteen miles inland from Mukhojin was connected to that port by a narrow-gauge railroad. The coal was low grade anthracite which came out in powdered form. During the war, production is reported to have reached 60,000 tons a month for the area. At Mukhojin large storage bins were constructed and from them conveyor belts loaded coastal ships. Partly based on this resource, but also dependent on coal and other materials from Japan and northern Korea, were the large-scale industrial installations at Samchok. Chemical and carbide plants produced fertilizers and other war material. A cement plant used some of the nearby limestone and coal for its production.

A railroad paralleling the coast-line was begun in order to aid industrial and other developments. Construction was started from the north and by the Fall of 1938 the railroad was operating from Anbyon, the junction point on the Seoul-Wonsan line, south as far as Yangyang. Along the railroad, stacks of firewood, bags of rice, fish meal cakes and cans of fish oil showed the traveler how important the line was in opening up the Littoral as a source of raw materials. The Japanese continued construction of the road bed, despite difficulties of the varied terrain with its narrow valleys and abrupt headlands. During war years tunnels and embankments along the entire line were finished. However, due to scarcity of rails and equipment, only the section from Mukhojin to Samchok was put into operation. As part of the plan of opening the Littoral, a bus and truck highway, suitable for all-weather use, was constructed. It was kept in repair by labor from the villages near which it passed. Along the route went most of the land traffic. The settlement pattern was changed in places because of the attraction of roadside location for new villages.

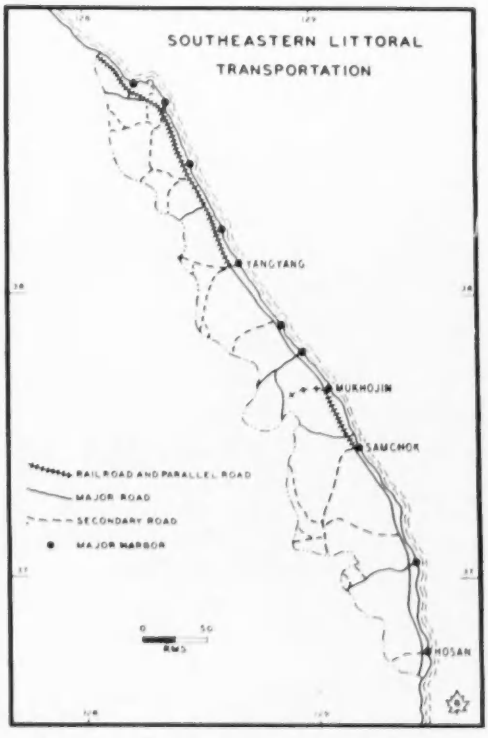

FIGURE 5.—Transportation Facilities in the Southeastern Littoral. This map is based on the Map of Korea, Scale 1:1,500,000, with additional data plotted from the Provincial Map, Scale 1:500,000 and from travellers' accounts.

As the war progressed the Japanese faced a major shipping crisis caused by loss of an overwhelming proportion of their merchant marine. To provide alternate forms of shipping many fishing vessels were taken to the coastal waters of Japan and an ambitious plan to build many small wooden ships was inaugurated. The program required a great quantity of large-sized timbers. Thus ruthless cutting of the excellent pine forests on the slopes of the Taepaek Range took place during 1944 and 1945. The timbers were brought down to Hosan by a 18-mile timber railroad. Some were shipped from the concentration point to Pusan at the southeastern end of the Korean peninsula or to Japan. But before all of the timber could be cut or shipped, Japan's surrender terminated destruction of the forest.

PEACE—RUSSIAN AND AMERICAN VERSION

With collapse of Japan, Korea was freed from the Japanese over-lords, but instead of being given immediate independence was occupied by American and Russian troops. The forces were ostensibly for the purpose of demilitarizing the Japanese troops and overseeing their evacuation. The dividing line between the two occupation zones was an arbitrary one, the 38° parallel. It cuts directly across the Littoral, separating it into two unequal parts and destroying the unity of the region. Although more than a year has gone by there has been no successful effort to abolish the line and allow Korea to become unified. Little knowledge leaks out concerning activities on the Russian

FIGURE 6.—A Landscape in the Southeastern Littoral. The village in the foreground is in one of the isolated valleys. Some of the homes are thatched with bark and stones. The two-story house in the center is a tin-roofed Japanese dwelling. The line along the hill in the background is the new road. The eroded hills, the lagoon and bay mouth bar in the valley and the jutting headland are typical of landscapes along the Littoral.

side of the Littoral. Presumably the railroad is functioning and probably the northern part of the region is being closely drawn into the economy of the Wonsan area. Since the occupation-zone boundary is only an artificial one and follows no visible relief features, several border incidents have taken place between American and Russian troops. The border is patrolled and Koreans are not allowed to trade across the line.

In the American zone, life is hard. The region was never a surplus food area. With lack of adequate fertilizer and good seed and with unsettled marketing conditions consequent upon inflation, production of foodstuffs has been difficult. If the area were not so predominantly agricultural, suffering would be even greater than it is. However, Korean farmers are going out in small boats to gather seaweed to dry for food or to spread on their fields for fertilizer. They are doing their best, despite their inadequate food intake and consequent loss in strength, to plant their fields and grow some food crops. Many are double-cropping their fields more than is customary. Despite such struggle toward self-sufficiency, rice must be brought in from southern Korea.

During the first months of occupation when restraints were not enforced on cutting, many Japanese reforestation areas were again denuded of their stands. Serious floods and erosion have resulted already. Stocks of timber at Hosan have been of great aid to the occupation forces. LST's have been taking some of this timber to Pusan and south Korea to use for railroad ties and construction material.

Other resources of the region are slowly being fitted into the changing political and economic picture. Coal mines are being reopened to provide fuel for industrial and heating requirements of the American zone. Production at the mine near Mukhojin in April, 1946 was only 4,000 tons per month, but was raised to 40,000 tons by July and it is hoped will reach 100,000 tons by December. Local industrial plants have not been operated on a major scale because of shortages of some key materials, formerly imported in small amounts from Japan. For example, the plant at Samchok was allocated, only after months of delay, one and a half tons of ammonia a month for six months, and with that will be able to produce 7,000 tons of needed nitrogen calcium cyanamide. The plants are endeavoring to produce some consumer goods such as soaps, silk, fertilizers and cement.

The fishing industry is being revived, although requisitioning of the boats by the Japanese during the war and scarcity and deterioration of nets and equipment virtually paralyzed modern phases of the industry. The Japanese have all been repatriated and technically-trained Koreans are few in number. American authorities, however, are optimistic over the future of fishing in the area and are laying a strong foundation for it.

The economy of the Southeastern Littoral cannot become stable for some years. The agricultural economy, presently characterized by a high degree of tenancy, will probably go through considerable turmoil, depending on the political complexion of the future independent nation. Ultimate ownership of the Japanese-controlled fishing and industrial installations is a knotty problem. If the region can be unified again, if fishing and other industries are established on a sound basis to complement a more scientific agricultural economy, and if good transportation facilities

can be developed, the Southeastern Littoral may emerge as one of the important regions of Korea. The railroad line, when completed, will be a unifying force that will bring many changes to the isolated valleys. One of the enduring resources of the region, the beauty of the land with its myriad headlands and picturesque mountains and plains, may then be exploited for a tourist industry that will acquaint many people with this region of Korea.

ECONOMIC REHABILITATION IN EIRE

Harold E. Hall

THE past seven years have resulted unprecedented stress in Eire, with the war and its aftermath forcing adoption of many measures more or less alien to the natural economy of the country. Today Eire is planning a sound postwar future and is doing everything possible to ameliorate its economic disabilities.

Eire felt the discomforts of the war without being an actual participant in it. Its geographical proximity to the European battle scene, its commercial relationship with the United Kingdom, and its dependence on external sources for certain raw materials and foodstuffs made it impossible for the country to escape unscathed from the economic consequences of the war. Today food is rationed, traditional methods of agriculture have been abolished, and closer control over the nation's economic life is being supervised by the Irish Government.

Comprising the 26 counties of Southern Ireland, Eire has an area of 26,935 square miles, about the same as the state of Maine. Topographically the country resembles a basin. The center of Eire is a great plain covering a patchwork of rich pasture lands, tilled areas, and turf bogs, while the seaboard is fringed by ranges of hills and mountains of 2000–3000 feet in height. The eastern shore has few conspicuous inlets, whereas the western coast is deeply indented with bays. Lakes of varying sizes dot the countryside.

Eire was originally covered with large forests, but now only one per cent of the land is covered with woods, and less than half of the normal consumption of wood is supplied from domestic sources. The Government has engaged in an extensive reforestation program, planting thousands of trees of the coniferous species, including Douglas fir, Scotch and Corsican pines, common and Sitka spruce, larch, and silver fir.

Approximately one-seventh of the land is covered with peat bogs. In pre-war years about 7,000,000 tons were dug annually, all of which was cut by hand. Consumption of peat has increased considerably since 1939, with disappearance of coal imports from the United Kingdom. Aside from peat and limited deposits of coal, Eire has little mineral wealth.

Climate and Rainfall

The physical situation of Eire is responsible for its moderate climate. Extremes of temperature from 28 degrees to 87 degrees are favorable to production of agricultural crops. Mean average temperature in Dublin is 49 degrees, while humidity averages 83 per cent.

Average precipitation over a long period of years permits rough separation of the wet and drier districts by a line conforming more or less to the southwest-northwest axis of the country, deflecting in the south of the Dublin area and passing through Limerick, Tipperary, and Kilkenny. Dublin averages 28 inches annually, whereas the middle-north and south coastal districts receive about 40 inches, the western coast between 50 and 60 inches, and the extreme southwest an annual precipitation of nearly 70 inches.

DECLINING POPULATION

Present population of Eire is estimated at 2,985,000, and a study of population statistics uncovers three unusual features. First is unbroken decline in population of the country, which in 1841 totalled 6,529,000. The decline has been attributed primarily to emigration, a situation which was greatly accelerated during recent war years. Incessant demand for labor in the United Kingdom has resulted in emigra-

FIGURE 1.—Eire comprises four provinces—Leinster, Munster, Connaught, and Ulster—which serve no present political function but were formerly political units.

tion of an estimated 225,000 Irish laborers to that country since 1939, despite attempts to retain able-bodied men for agricultural work.

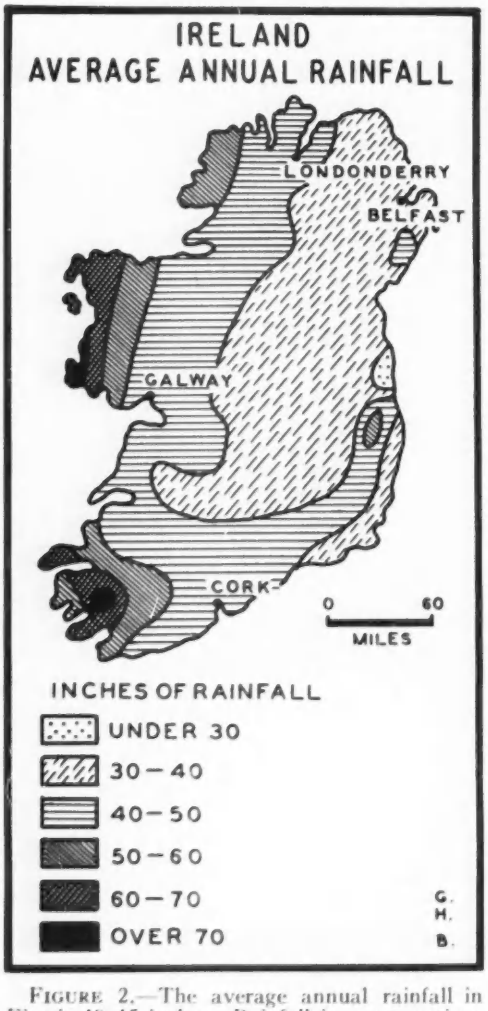

FIGURE 2.—The average annual rainfall in Eire is 40–45 inches. Rainfall in most sections is fairly evenly distributed throughout the year. A day of constant sunshine is exceptional in all parts.

The second feature is low ratio of females per thousand males. The 1936 census figure of 952 females for 1000 males gave Eire lowest ratio in Europe. The abnormal sex distribution has been primarily result of female emigration. Recent improvement in the general ratio, which had climbed to 980 in 1943, is related to the fact that during the 1936–1943 period, proportion of females in the net total of emigration declined from 56 per cent to approximately 18 per cent.

Change in areas in which decline of population has been centralized is the third feature of the population picture. Between 1841 and 1943, actual number of persons living in towns changed but little, with any loss in urban population being counterbalanced by inflow from rural areas. Loss in population was carried practically entirely by rural districts. The population enumeration of 1943 was the first since 1891 in which towns with 1,500 inhabitants and over suffered decline in population.

Almost three-quarters of the population lives in rural areas or in towns of less than 5,000 inhabitants, and 48 per cent are engaged in agriculture. As recently as 1870 over half of Eire was owned by 750 landlords, and some 90 per cent of the rural population rented their holdings. While the condition of tenants was never good, it became progressively worse during the first half of the nineteenth century. The British Government, after trying to regulate the relationship of landlord and tenant for several decades, shifted emphasis toward aiding tenants to become proprietors. The change was successful, and from a classical land of absentee landlords and yearly tenancies Eire has now been converted into a country of small farm proprietors.

GOVERNMENTAL ENCOURAGEMENT FOR AGRICULTURE

The war focused official attention on the twofold problem of securing high degree of self-sufficiency in foodstuffs to replace imports lost as result of displaced shipping and upon importance of continuing Eire's valuable agricultural export trade with the United Kingdom. In an attempt to counteract

curtailment of imported commodities the Government has resorted to a system of subsidies, guaranteed prices, low-interest loans to farmers, and other incentives to increase home production. Under impetus of this drive, total area tilled increased from 3,554,000 acres in 1939 to 4,440,000 acres in 1945, and total value of Irish agricultural production during the same period increased from £53,000,000 to £99,000,000.

Recent achievements of Irish agriculture are more impressive when it is realized that serious difficulties have been experienced in procurement of fertilizers, agricultural machinery, and, in many localities, of farm labor. Imports of fertilizers have declined by over 70 per cent in comparison to prewar years. This has resulted in general decrease in and vegetable production has also increased.

EIRE'S AGRICULTURAL ACREAGE
(In 1,000 acres)

Crop	*1939*	*1940*	*1941*	*1942*	*1943*	*1944*	*1945*	*1946 (est.)*
Wheat	255	305	463	575	509	642	662	641
Oats	537	681	782	878	936	945	823	828
Barley	74	132	163	186	209	168	170	142
Potatoes	317	367	428	426	408	412	388	387
Turnips	141	151	157	146	143	144	152	152
Sugar beets	42	63	78	55	83	82	85	78

The major problem facing Irish agriculture is production of wheat. Soil and climate of Eire are not particularly adapted to wheat production, and a much more profitable market has been available in the United Kingdom for Irish livestock and dairy products. Consequently domestic production of wheat was of minor significance during immediate prewar years and the country became dependent on imports from foreign countries, principally Canada.

In 1944, when wheat imports declined by 40 per cent, compulsory production was adopted. Acreage tilled in wheat increased substantially, and in 1945 acreage devoted to wheat was 662,000, highest since 1849. Today the Government is attempting to increase wheat acreage to 700,000, which it is estimated would make Eire self-sufficient in that commodity. Production of oats, barley, potatoes, turnips, and sugar beets has also increased, and in general, the commodities are now produced in quantities sufficient to meet normal local demands, but without appreciable surplus. Fruit yield per acre amounting to approximately 12 per cent in case of wheat and oats and 20 per cent in yield per acre of potatoes.

Aside from present demand for increased production of wheat, the British market for foodstuffs is the first factor of importance in Irish farm economy, and rivalry between tillage and pasturage production is historical. When the British free trade policy came into being with repeal of the corn laws in 1846, production of many cereal crops on Irish farms became unprofitable, and tillage declined, while pasturage and number of livestock rapidly increased. The situation continued until outbreak of World War II when compulsory tillage was introduced by the Irish Government. Proportion of land under tillage increased from 8.8 per cent in 1939 to 16 per cent in 1945, while pasture land dropped from 47 per cent to 40 per cent during the same period.

The most favorable factor resulting from the war's influence on Irish agriculture has been continuing British

demand at high prices for Eire's livestock and dairy products. However, decreased pasture acreage, foot-and-mouth disease among livestock, and sharp reduction in imported feedstuffs have resulted in fewer animals being exported to the United Kingdom.

INDUSTRY IN EIRE

Eire has never been highly industrialized, although a relative degree of self-sufficiency has been reached in certain lines. Since 1939 Irish manufacturers have found themselves relatively free from foreign competition, and with an expanding home market. However, shortage of raw materials has proved difficult to overcome, and new industrial machinery and replacements have been difficult to obtain. Furthermore industrial production has been restricted by shortage of electrical power and fuel. During the war excess-profits taxation was heavy and absorbed considerable share of industrial earnings, and prices were controlled on all essential goods and services.

Among principal activities at present are bacon curing, woolen cloth, boots and shoes, brewing and distilling, confectionery, poplin, wearing apparel, grain milling, sugar, and tobacco products. Today Eire's principal industrial advantage over other nations of Europe lies in its reconversion speed. It has no problems of technical reconstruction or reconversion to peacetime basis. When foreign trade again permits uninterrupted flow of raw materials to Eire, that country will be in position to continue its efforts toward industrial expansion and diversification.

GOVERNMENT CONTROLS TRANSPORTATION SERVICES

Local transportation has been seriously affected by repercussions of the war. A total of 48,560 miles of road was maintained in 1945, but present condition of the highways is poor because of shortage of repair materials and diversion of labor from road upkeep to other industries. Decline in coal imports severely restricted railway operations. The Transport Act, 1944, provided for establishment on January 1, 1945, of a new transport company to be known as Coras Iompair Eireann (Irish Transport Company). The government-sponsored company practically controls all rail, road, and inland waterway transport in Eire. During the war railway passenger-train service was reduced to two days a week except on suburban lines, all dining cars were withdrawn, freight train services were limited to four days a week, and several branch lines in various parts of the country were closed. Although some easement of the stern conditions has since been realized, restrictions still remain on railroad travel. Regardless of such dislocations no financial losses were suffered by Coras Iompair Eireann, as passenger and freight receipts remain high.

Air transportation is under supervision of another government-sponsored company, Aer Lingus (Irish Air Lines) which operates services from Shannon airport to Dublin and from Dublin to London and Liverpool. The giant trans-Atlantic airport at Shannon furnishes accommodations for five companies (three American, two European) which are engaged in Atlantic passenger service, and the Irish Government has recently announced that their own planes will soon be engaging in trans-Atlantic flying.

FOREIGN TRADE DOMINATED BY GREAT BRITAIN

Eire's total foreign trade amounted to £76,000,000 in 1945, as compared with £70,000,000 in 1939 and £54,000,000 in 1943. However, the figures are based on value and do not present an accurate

quantitative picture of the situation, inasmuch as higher prices per item are involved. In addition, Irish import statistics are recorded on a c.i.f. basis and it is apparent that higher freight and insurance charges have tended to conceal an actual decline in volume of Eire's foreign trade.

able by the British Government to persons resident in Eire.

Agricultural products have long provided Eire with practically all its visible exports, principally in form of livestock shipped to British markets. In fact, dependency of Irish trade on the United Kingdom has long been a problem of

EIRE'S FOREIGN TRADE WITH MAJOR COUNTRIES, 1939–45
(In thousands of pounds sterling)

Item and Country	*1939*	*1940*	*1941*	*1942*	*1943*	*1944*	*1945*
Imports (total)	43,415	46,790	29,530	34,630	26,082	28,244	40,658
Great Britain	23,406	24,197	20,555	18,789	12,565	12,249	18,157
Canada	1,462	3,290	1,559	4,565	2,545	5,017	5,471
Argentina	2,327	3,816	491	1,342	735	1,621	1,832
United States	3,600	4,131	2,304	3,042	3,550	2,955	4,088
Other countries	12,620	11,356	4,621	6,892	6,687	6,402	11,110
Exports (total)	26,516	32,708	31,735	32,607	27,401	29,493	34,947
Great Britain	22,175	28,135	27,463	27,102	22,244	23,457	27,468
Northern Ireland	2,637	3,311	3,350	5,102	4,844	5,689	6,708
United States	288	491	702	298	266	288	371
Other countries	1,416	771	220	105	47	59	400

Although the established policy of the Irish Government in recent years has been to develop home industries, the country is dependent on imports for many essential commodities. During the war years Great Britain supplied between 50 and 60 per cent of the imports, but has declined slightly since 1942. Imports from Great Britain consist primarily of coal and textiles. Canada increased in importance as a supplier, providing Eire with 15 per cent of its total imports in 1945 as compared with only 3 per cent in 1939. Imports from Canada now consist mainly of newsprint and wheat. The United States is not an import supplier, but indications are that Irish-American trade may increase in volume and value in the next few years.

In normal times Irish imports are greater than exports, the import surplus being covered by payments of interest on investments held abroad, Irish sweepstakes receipts, emigrants' remittances, tourist expenditures, and pensions pay-

grave concern to Eire. Economies of the two countries are complementary and livestock exports offered by Eire are of the type required by the United Kingdom in increasing quantities from the most convenient source. With Great Britain normally purchasing more than 80 per cent of Eire's exports, and Northern Ireland taking 13 per cent, it is readily seen that favorable trade relations with the United Kingdom are essential to Eire. There is, however, tendency to look to greater diversity of trade with development of new export markets and importation of goods directly from foreign sources instead of as re-shipments from the United Kingdom.

FOREIGN TRADE OF EIRE

Year	*Value in Pounds Sterling*	
	Imports	*Exports*
1931	50,461,000	36,341,000
1938	41,414,051	24,245,657
1945	40,657,638	35,307,198

Acquisition of foreign supplies was handicapped to considerable extent during the war by lack of shipping facilities, and dependency of Eire on foreign shipping, principally British, was evident. In 1941 the Irish Shipping Company was formed to alleviate the difficulty. The company is a government-sponsored and subsidized concern which

FIGURE 3.—O'Connell Street, in Dublin, is the commercial center of the country. One-sixth of the total population of Eire is found in Dublin.

now operates a fleet of more than 25 ocean-going vessels.

RATIONING AND LIVING COSTS

Although not at war, the Irish Government found it necessary to institute rationing and allocation of limited supplies, and many of the regulations are still applied today. Limitations on consumption of coal, electricity, and petroleum are still in force, and the following food items are rationed in weekly amounts—tea, 1½ ounces; sugar, ¾ pound; and butter, 6 ounces.

Cost of living has mounted considerably since 1939, although present indications are that the rise has been at least temporarily stopped. Food has increased by 65 per cent, fuel and light by 83 per cent, and clothing by 90 per cent compared with 1939 levels. Wage and salary increases have been granted to meet the rise in the cost of living. Weekly salary of industrial workers producing transportable goods averages approximately 69 shillings ($13.80) for men and 38 shillings ($7.60) for women in 1945, an increase of about 20 per cent over 1939 figures. Agricultural wages increased as much as 45 per cent, from a weekly average of 27 shillings ($5.40) in 1939 to 40 shillings ($8.00) in the fall of 1945.

CONCLUSIONS

The primary object of the Eire Government today is to return the country as quickly as possible to a "normal" peace-time position, but not necessarily to the same status as prevailed in the prewar period.

FIGURE 4.—Limerick, Eire's oldest city, is located on the banks of the River Shannon. Nearby are found the trans-Atlantic airfields of Shannon, and the electrification project at Ardnacrusha. (This is an Official Irish Photograph.)

Need for improved efficiency in agriculture is evident, and it is expected that much will be done to increase fertility of the soil, to obtain maximum yield per acre, and to increase output per unit of labor. Compulsory tillage is to be continued throughout 1946, and continuation of guaranteed prices is advocated as means of expanding production and increasing agricultural efficiency.

The Irish Government contemplates

no immediate development of heavy industry, but efforts are being made to assist other new industries, particularly those producing consumer goods. The future of Irish foreign trade will, of course, depend largely on the international trade situation, and especially on receptivitity of British markets for Irish products. Through continued development of its new merchant marine and its nationalized system of transportation, and by adoption of other methods and modernizations in industry and agriculture, the Government hopes to direc Eire along a path of sound economic expansion.

A NEW COTTON BELT IN CHINA

Hu Huan-yong

SOUTH and north of the Yangtze River spreads an elongated strip of coastal plain of Kiangsu Province, which ranks as one of the important cotton regions in China. In the southern part cotton has been cultivated for centuries, whereas to the area north of the river cotton was introduced only very recently. It is the latter area that constitutes the new cotton belt. This paper deals with some economic and geographical aspects of the new cotton belt.

In northern Kiangsu there is an old dike running north to south, called Fankung Ti, which was built in the seventh century in an attempt to protect inland crop land from sea water. Since that dike was built the land has extended seaward about 40 miles, as a result of deposition of the Yangtze in the south and the Hwaiho and the Hwangho in the north.

The newly emerged coastal plain was used for salt works. The salt, produced by boiling the highly saline underground water, has been known as Hwainan salt, and has for long monopolized the market of the middle and lower Yangtze provinces. Till the seventeenth century the Hwainan salt field was the most productive and important in whole China.

As the land extended farther and farther into the sea the salt field was pushed nearer and nearer the coast, and the old salt field became suitable for reclamation as the salinity of the underground water became lower and lower. Rice culture is possible only in the western part of the region where salinity becomes negligible. So far as soil salinity is concerned, cotton is less exacting and can withstand salt soil better than most other crops. Not only does cotton form the sole important cash crop in the entire region, but in some areas it constitutes the only crop grown. Since it was first introduced about forty years ago, expansion of its area has been remarkable. In 1934 there were 5,800,000 mou (930,000 acres) of cotton in this new belt, which accounted for one-eighth of the total cotton acreage of all China.

In 1934 the author, with some of his students, made an excursion to the region, for which a report in Chinese was published by the Department of Geography, National Central University. It seems to them that the region has a bright future in prospect, as there are still 8,610,000 (1,377,000 acres) of land that can be improved for cultivation of cotton or other crops. It is for this reason that a discussion of all the important aspects and factors involved in the present use of the land seems desirable.

1. Its Surface Feature and Area

As it forms part of the newly emerged coastal plain the land surface is low and level. The general elevation is only six to fifteen feet above sea level, with result the watertable comes very near to the surface, usually ranging from three to six feet below. Salinity of the underground water increases inversely with distance from the sea. The region is ill-drained, and the sea water encroaches upon the land when it is in high tide. A long dike parallels the coast to prevent submergence by the sea, and irrigation

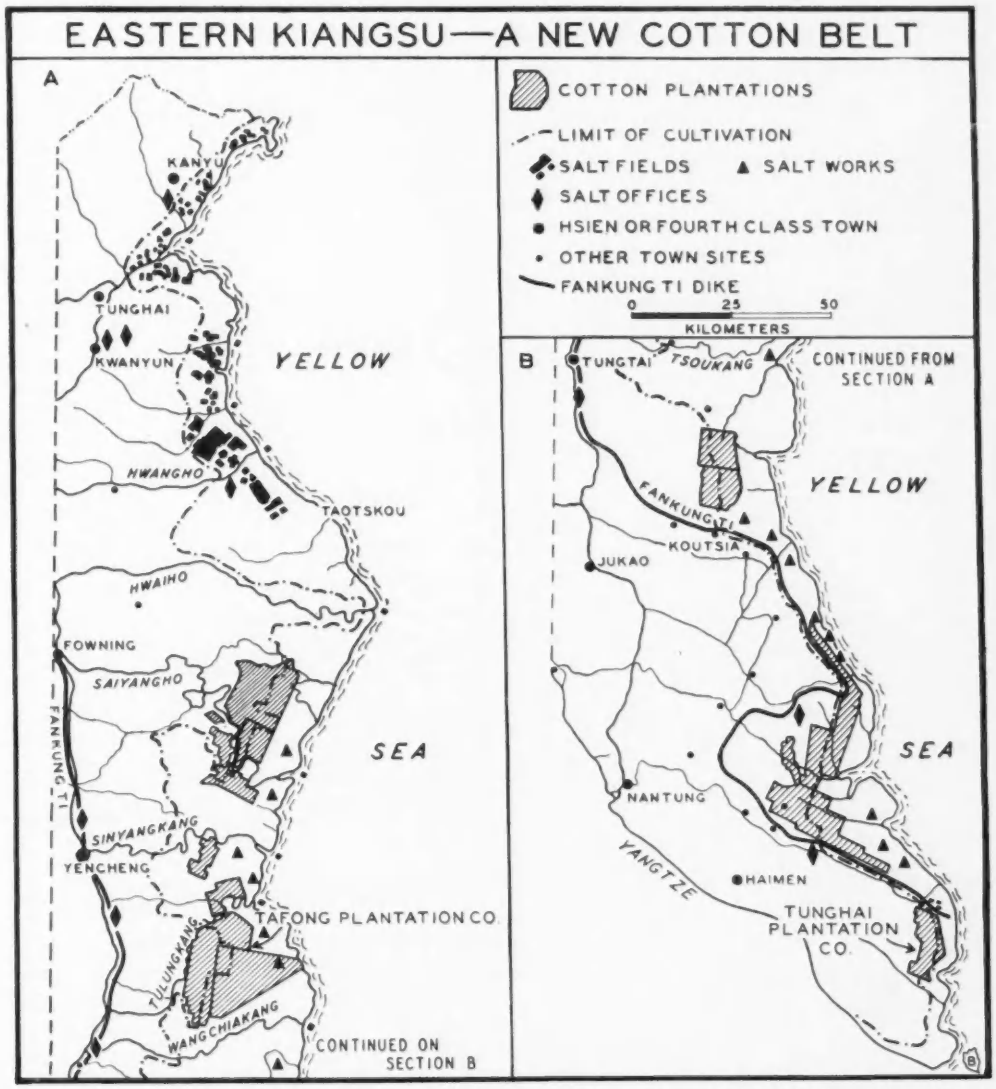

FIGURE 1.—The coastal belt of eastern Kiangsu where a new cotton belt with distinctive plantation development and unique one-crop agriculture has been established upon the low, level, fertile plain, wherever salinity has been reduced to permit growth of cotton. Several extensive areas of productive land have been monopolized by the plantation cotton.

ditches to accelerate surface flow must be constructed before the land can be reclaimed to grow cotton.

The whole coastal plain of northern Kiangsu is a long strip of land about 40 miles in width and 160 miles in length. In general the western part raises rice and cotton as chief crops; in the central, cotton predominates; while in the eastern part, the land is still barren. The total area amounts to 6,600 square miles or 25,600,000 mou (4,260,000 acres) of which two-thirds has been cultivated. The following table shows the area of cultivated and uncultivated land for various inter-fluvial regions of the coastal plain of northern Kiangsu arranged from north to south, as measured from the topographical maps on the scale of 1:50,000.

TABLE I

AREAS OF INTER-FLUVIAL REGIONS OF THE COASTAL PLAIN OF NORTHERN KIANGSU

Regions	*Total Area Mou*	*Cultivated*		*Uncultivated*	
		Mou	*Per Cent of Total Area*	*Mou*	*Per Cent of Total Area*
Hwangho-Hwaiho	1,732,500	375,000	22	1,357,500	78
Hwaiho-Saiyangho	2,707,500	1,807,500	67	900,000	33
Saiyangho-Sinyangkang	2,850,000	1,931,000	68	918,750	32
Sinyangkang-Tulungkang	1,631,250	1,031,250	63	600,000	37
Tulungkang-Tsoukang	2,784,750	1,042,500	38	1,076,250	62
Tsoukang-Fankungti	5,352,000	2,381,250	45	2,943,750	55
South of Fankungti	9,078,500	8,884,500	98	175,000	2
Total	25,624,500	17,023,250	66	8,610,250	34

(1 mo = 0.16 acre)

2. CLIMATE

Northern Kiangsu lies in a transitional climatic zone between North and South China. The major climatic conditions concerned with the growing of cotton are essentially distribution of temperature and rainfall and the frost-free season. A brief analysis of the three critical elements follows:

The temperature of the cotton belt is rather high in summer and low in winter. High summer temperature is ideal for cotton culture. At Nantung, located at the southern end of the region, there are four months with an average temperature above 20° C. (68° F.), the average July temperature being as high as 26°.9 (80° F.). At Yencheng, about sixty miles farther north summer temperature is even higher than at Nantung, and there are five months above 20°, with a July monthly mean 29°.2 (84°.5 F.), which is 2°.3 higher than at Nantung.

The frost-free season in this cotton belt averages 200 days. It is 238 days at Nantung and 206 days at Tungtai. The absolute frost-free season (the shortest ever recorded) is 198 and 184 days for Nantung and Tungtai respectively. It is almost certain that farmers can have their cotton picked before the first frost comes.

The annual rainfall decreases gradually from south to north; it is 930 mm. at Nantung in the south and 781 mm. at Fowning in the north.

The rainfall regime is of monsoon type, i.e. the larger part of rainfall occurs in summer season whereas the winter months are relatively dry.

Variability of rainfall is rather high. At Nantung the highest precipitation was 1,524 mm. in 1931, and the lowest only 622 mm. in 1934. The highest record of Fowning was 1,380 mm. in 1926 and the lowest only 386 mm. in 1924. For growing cotton variation of

TABLE II

TEMPERATURE (0°C.)

	Jan.	*Feb.*	*Mar.*	*Apr.*	*May*	*June*	*July*	*Aug.*	*Sept.*	*Oct.*	*Nov.*	*Dec.*
Nantung	1.6	3.0	7.4	13.0	18.7	22.8	26.9	26.9	22.4	17.4	11.2	5.0
Tungtai	1.4	4.7	9.8	16.1	21.5	25.5	28.4	29.1	24.4	19.0	11.0	4.2
Fowning	-0.2	2.6	7.1	13.3	20.3	24.9	28.5	27.9	23.3	17.7	10.1	3.0
Yencheng	1.4	3.5	7.6	12.9	20.0	24.4	29.2	28.6	23.3	17.2	10.9	5.6

TABLE III

Frost

	Mean First Frost	*Mean Last Frost*	*Mean Frost-free Season*	*Absolute First Frost*	*Absolute Last Frost*	*Absolute Frost-free Season*
Nantung	November 9	March 15	238	October 18	April 3	198
Tungtai	October 31	April 7	206	October 24	April 22	184

TABLE IV

Average Precipitation (MM.)

	Jan.	*Feb.*	*Mar.*	*April*	*May*	*June*	*July*	*Aug.*	*Sept.*	*Oct.*	*Nov.*	*Dec.*	*Year*
Nantung	28	37	50	66	64	150	174	131	124	25	40	39	930
Tungtai	31	34	43	56	62	122	174	171	93	41	37	47	911
Yencheng	32	32	43	71	66	134	202	175	102	35	33	47	970
Fowning	31	26	26	52	54	102	197	137	63	31	27	35	781

annual rainfall is not so important as that of rain in autumn which may inflict damage to the crop if it is very much above normal.

Chief threat to the cotton crop is the fall typhoon, which occasionally reaches the region. Not only the torrential rains brought by typhoon damage the crop but also the strong northeast wind may drive sea water onto the land, which spoils the cotton fields by high salinity.

3. Soil and Drainage

According to the soil survey made by the Geological Survey of China, this region, physiographically, may be divided into three parts. The southern part is the alluvial plain built by the Yangtze, the central part represents the deposition of both the Yangtze and the Hwaiho, while the northern part is the result of the accumulation of the Hwaiho and the old Hwangho.

A study by Mr. S. T. Yang of the Agricultural College of Nantung University reveals that salinity of the soil has an intimate relation to plants grown in the region. Cotton flourishes only in soil of which salinity is below 0.16 per cent. In the land where the salinity is 0.38 per cent cotton can be grown only very poorly. If the salinity increases to over one per cent nothing but wild weeds can survive. Wherever the salinity runs to over 2.6 per cent barrenness is the rule.

As previously stated, the underground water is also very saline. The level of the watertable, therefore, has an important bearing on use of land. Generally, only in areas where the watertable is more than 5 feet below the surface is the land cultivable. In order to lower the watertable and reduce the salt content of the soil drainage ditches are necessary to accelerate the surface flow. A dike running north to south on the seaward side of the cotton land is also a requisite to prevent inflow of the sea water. Both ditches and dikes are essential to reclamation of the land.

4. Cotton and Other Crops

In the western part of the coastal plain there are more rice fields than cotton fields, but in the central part cotton constitutes the only crop grown in the fields. The area forms a true mono-crop region. Based upon county returns the

cotton acreage and its production are shown as follows.

TABLE V

COTTON ACREAGE AND PRODUCTION

County	1930		1932		1934	
	Area (1,000 mou)	Production (1,000 pic.)	Area	Production	Area	Production
Chitung	800	118	550	46	520	49
Haimen	723	78	720	67	757	78
Nantung	1,316	102	1,189	270	1,537	330
Jukao	710	63	480	102	910	148
Tungtai	630	52	600	125	1,262	259
Yencheng	229	19	150	24	350	53
Fowning	192	13	375	53	480	46
Total	4,600	445	4,070	687	5,816	963

(1 mou = 0.16 acre, 1 picul = 130 pounds)

Owing to differences in soil salinity, productivity of the land varies with area. Generally speaking, in the western and southern parts yield per unit of land is higher than in the eastern and northern parts. Highest yield per mou may be two piculs, while poor land can yield only one-tenth as much. Although total production fluctuates with variation of climatic conditions from year to year, yet, based upon prewar records, the general trend of both production and acreage is toward increase.

5. COTTON PLANTATION

The region is unique and distinctive not only in its one crop system, but also by its plantation agriculture. The first plantation was established by Tunghai Plantation Company, formed in the beginning of this century by the famous pioneer, Chang Chi-chih, of Nantung. Since then, many other companies have been formed, like mushrooms, to exploit the vast stretch of virgin land. In 1934 there were 24 companies each having an area of more than 10,000 mou. Fifteen of the twenty-four companies possess an area over 100,000 mou each. Among them the Tafong Company of Tungtai is largest, which had at its start 1,120,000 mou of land, and still has 600,000 mou after sale of a portion of its land.

All salt fields are government-owned. When the salt industry becomes difficult on the original fields owing to decreasing salinity of the underground water as the coastal plain extends toward the sea, the Government sells the land cheap to the public, sometimes as low as one Chinese dollar for each mou. But the bulk of the expense for reclamation is for building dikes and ditches prerequisite to cultivation of the land. As independent farmers could not afford to pay for reclamation, large plantation companies were organized to undertake the task. Reclaimed lands are rented in lots to the tenant farmers who, in turn, pay the respective companies one to three dollars for each mou of land, according to its fertility, as a rental. At first the company even provides its tenants with houses and farm implements for which they must pay for in later years. The company receives about one-third of the crop from the tenants as rent, and the rest goes to the tenants. The tenants may sell their right of cultivation to others, provided that the new tenants continue to pay rent to the company.

It is interesting and significant to note that, as the cotton plantations

were established in the counties of Nantung and Haimen, almost all the farmers in this central and northern location of this new cotton belt were immigrants from the two counties. They speak a Shanghai dialect quite different from the local dialect.

6. Tunghai Plantation Company

The Tunghai Plantation Company is the oldest and also the most successful of all companies. It started with a capital of 560,000 dollars divided into 4,000 shares, of which one-third was spent for 120,000 mou of land and the rest for dikes and ditches. Several times the dikes were broken by violent typhoons, but again and again they were built anew; they are about 15 feet in height and 100 miles in length. Along the dikes there are several parallel ditches which are 6 feet in depth and 50 feet in width. A large lock is installed to check inflow of the tidal waters.

Each tenant farmer received a plot of 20 mou by depositing 120 dollars as security that his contract would be carried out, then paid one-third of his crop to the Company as rent. The cultivated land was valued in 1934 at 20 to 50 dollars per mou according to the fertility of the land.

Shareholders of the Company received no dividend in the first ten years. Since the eleventh year each share received annually a dividend varying from 10 to 60 dollars depending upon fluctuation of cotton price and yield per mou. In 1934 the major part of the Company-owned land was divided among the shareholders. Besides the dikes and ditches and other public land, each share received 22 mou of cultivated land. The Company is now no more than an agent, leasing the land and collecting rent for the landowners.

7. Tafong Plantation Company

Tafong Plantation Company is largest of all, formed in 1917 with headquarters in Tungtai County. It had an initial capital of 2,000,000 dollars with a land area of 1,120,000 mou. Owing to excessive expense of drainage works and many damages caused by floods and insect diseases, the Company was deeply in debt by 1931. In 1934 it had 200,000 mou under cultivation, after selling 240,000 mou to other companies. In addition, there were 380,000 mou of land protected with dikes and 300,000 mou left idle without any improvement.

In 1934 the 200,000 mou of cultivated land were operated by 4,000 tenants. In early years, tenants had to pay half their crops as rent and were not allowed to sell their right of cultivation. As a result, troubles, even revolts, were frequent among the tenants. Since 1928 the Company reduced the rent to one-third of the crop harvested.

The drainage works are remarkable. There are, in all, 200 miles of dikes 6 feet wide at the top, 300 miles of highways, 100 miles of canals and 700 miles of irrigation ditches.

8. Small Proprietors

Plantations are the significant features in the central belt. However, small proprietors are dominant in the western belt. According to the author's estimate, total area of the coastal plain amounts to 6,600 square miles or 25,600,000 mou of which about two-thirds are owned by small proprietors. They cultivate about four-fifths of the cotton fields of the whole coastal plain. All the large plantation companies combined own an area of 4,000,000 mou of which only 1,200,000 mou are cultivated, and the rest still remain unproductive.

9. UNCULTIVATED LAND

It is the potentially cultivable but uncultivated land that arouses special interest and attracts attention. At present there are about 2,240 square miles or 8,610,000 mou of land uncultivated near the coast, of which one-third belong to plantation companies and the rest are government-owned. One-half the uncultivated land is grass-covered whereas the other half is barren. If provided with adequate drainage, the barren land can be brought under cultivation. So there still remains an area of 8.6 million mou of land to be improved.

10. WORK OF IMPROVEMENT

Before the Sino-Japanese War the National Government and the Provincial Government of Kiangsu had made a joint plan for improving the idle land. An extensive dike along the coast and a large canal parallel to the dike were proposed. The dike, as projected, was to be 20 feet high and 13 feet wide. According to trustworthy sources in the National Conservation Board, the new canal was to be 132 feet wide, 13 feet deep (3.3 feet below sea level) and 167 miles long, extending from Koutsia in the south to Taotskou in the north. The cost was to be 8.3 million Chinese dollars at their prewar value.

Owing to change of course of the Hwangho since 1938, the region may become victim of the combined flood waters of the Hwaiho and the Hwangho in summer. Efforts should be made, first of all, to have the two rivers improved. Nothing will be possible if they are out of control. The yearly crop of a million piculs of cotton will undoubtedly justify the cost required for such improvement.

SETTLEMENT PATTERN OF THE LISTOWEL REGION, SOUTHWESTERN ONTARIO

D. W. Kirk

THE necessity of studying sequential development of an area as a prerequisite for understanding its present settlement pattern has been questioned; but for certain types of regions, like the Listowel district of Southwestern Ontario, the importance of such procedure is clear. Lying in a flat clay plain, the Listowel Region has had no part in the great industrial expansion of the major railway belts south and east (Figure 1); it is still strongly under the influence of conditions which prevailed in years immediately following settlement, manifested today in irregular distribution of urban communities of the region (Figure 2). The manner in which those conditions have had their affect must be studied before the present community pattern can be understood.

The Present Community Pattern

Three sizes of communities may be recognized in the Listowel Region; (1) towns of over 800 inhabitants, (2) villages with a population ranging from 250 to 800, and (3) hamlets with less than 250 people. There are six towns; they are fairly evenly spaced about the region. The villages, on the other hand, are irregular in distribution. For example, the township southeast of Town B has no villages, whereas that to the northeast has three—two only a mile and a half apart. The number of hamlets increases from northwest to southeast; the northern three townships have only five such centres, whereas the southernmost three have fourteen. Such pattern of communities, irregular as to both location and size, can be related to certain landscape features of the region; two, the drainage pattern and the railway pattern, discussed in this paper.

Examination of the relationship between settlement pattern and the two river networks—Maitland on the left and Grand on the right—will reveal the following correlations (Figure 3):

(1) Four of the six towns are located on streams; one at the major junction of the branches of the Maitland; another, Town B, ten miles up one branch. Listowel and Town H are located near sources of two others.

(2) Six of the nine villages are on rivers, but only twelve of the twenty-nine hamlets are so located.

The map also shows (1) that the extensive area drained by the Maitland streams has few hamlets and an irregular pattern of villages; (2) that the watershed belt is dotted with hamlets and evenly-spaced villages; and (3) that the Grand River zone has characteristics of both other areas. Thus communities are strongly related to the stream network, each size-group being affected in its own way.

A comparison of the settlement pattern with the railroad network, reveals a more definite correlation. All six towns except Town B, the smallest, are railroad junctions, and all villages are located on railroads. At the same time, however, only nine of the twenty-nine hamlets are so located, suggesting

that hamlets are repelled from railroads even more than from rivers.

We thus find that distribution of various community centres has been affected by stream distribution, whereas size of communities is strongly correlated with the railroad network. Reasons for the dual nature of the relationships may be found in the field of historical sequence.

THE GROWTH OF THE COMMUNITY PATTERN

When this part of Ontario was being settled one hundred years ago, the pioneers tended to move into an area by two means: (1) along trails formed on blazed Government survey lines, and (2) along rivers. As the frontier of settlement moved forward in a district, need arose for a network of hamlets to supply the commercial and industrial needs of the settlers; they tended to concentrate naturally along routes of migration and trade. Thus it came about that the first community pattern in the Listowel Region showed strong relationship to river and survey lines, a relationship which was still noticeable at the time of the coming of the railroad (Figure 4). In the watershed belt the survey line was the main locating force; elsewhere it was the river.

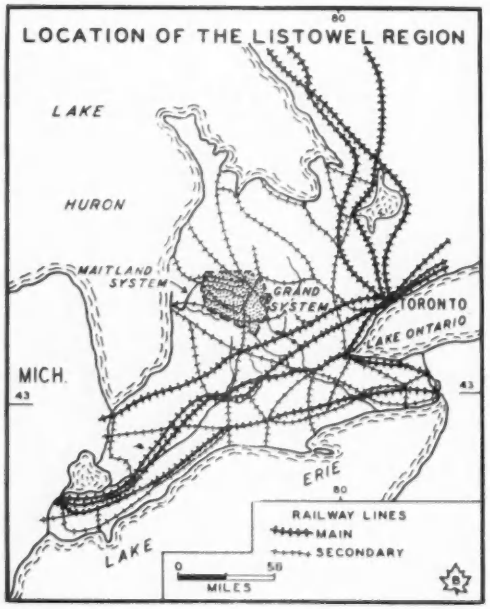

FIGURE 1.—The listowel region lies in a flat clay plain. It has had no part in the industrial expansion of the major railway belts south and east. Conditions that prevailed early in its settlement still exert their influence upon its character.

Rivers offered particularly favorable sites for early supply hamlets. Flow of water was useful in running pumps, in removing waste, and in performing other functions related to pioneer domestic industry; but it was only a short time after the Listowel area was settled before industry began to move from the household and small shop to the mill or factory and the high output of the district in lumber, grain and livestock inevitably led to a great network of sawmills, planing-mills, flour-mills, grist-mills, tanning factories, wool-carding mills and so on. Many an early supply hamlet soon developed into a small manufacturing centre. Such mills had two feasible sources of power: (1) steam, from water and wood-fuel, and (2) water-power from streams. In the watershed belt, mills made use of steam power without much trouble, and the community distribution pattern was not seriously affected by the coming of the mill period except that the larger centres, obtaining large steam mills, grew in size. There were plenty of water-power sites, and mills were constructed at such points. Thus it came about that in the region dominated by the Maitland streams communities unable to use water-power for the most part disappeared in competition with those more favorably endowed. By 1871, while there was still a polka-dot arrangement of villages and hamlets in the watershed belt, in the river zone of the northwest there prevailed irregu-

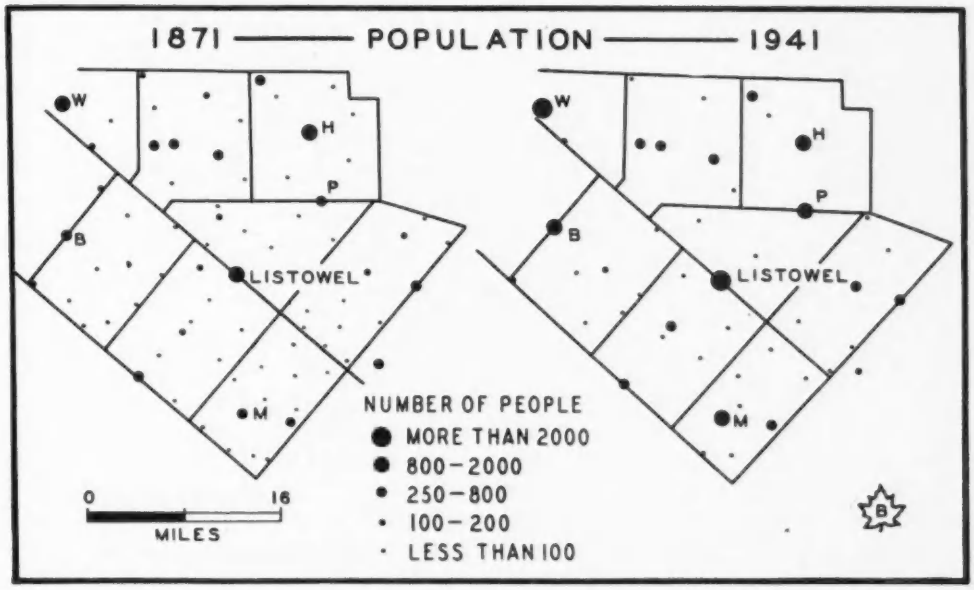

FIGURE 2.—Comparative development of distribution of population in 1871 and 1941 a period of seventy years, indicates relatively static influences.

lar distribution of villages along the rivers, and conspicuous lack of hamlets.

While streams of the Maitland and Grand systems determined location of towns and villages inside their own spheres of influence, they did not cause the watershed belt to suffer from lack of larger centres. Inside that watershed belt communities were quite as able to build up through the use of steam power, a pre-railroad industry as were the better-endowed centres in

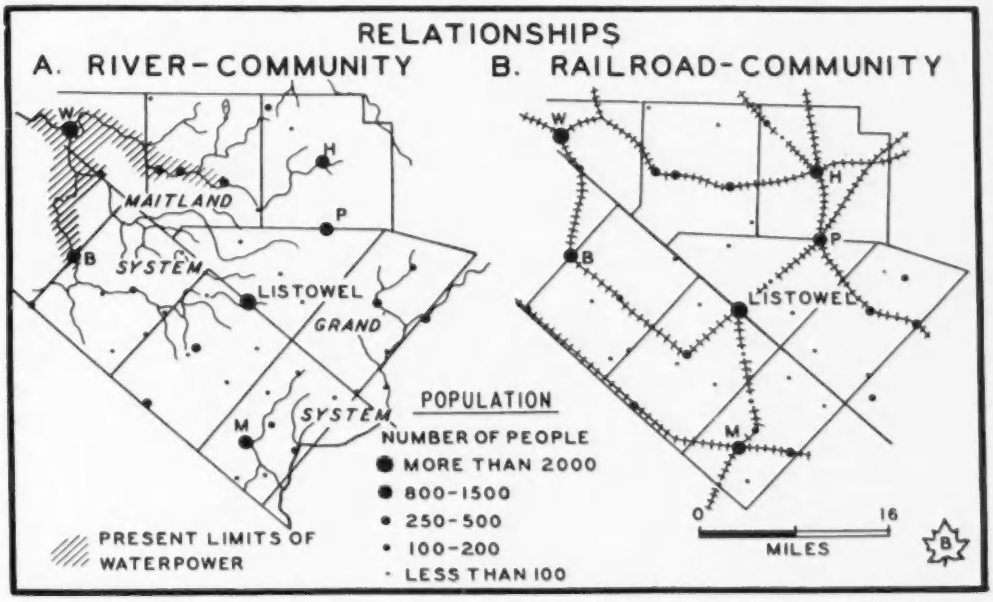

FIGURE 3.—The relative significance of early stream transportation as compared with later railway development in the Listowel area, is clearly revealed by this figure.

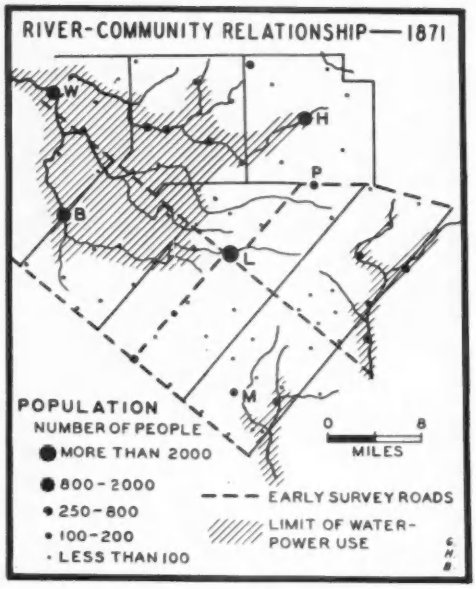

FIGURE 4.—Limit of water-power use up to 1871 at least, in relation to population indicates a close river-community relationship.

the water-power districts. The largest community of the whole region, Listowel, had never used water-power; it lay on a Maitland branch, but so far upstream as to be beyond the limit of water-power potential. Town H, the fourth largest, was already abandoning its use.

Distribution of larger centres through both river and watershed districts was important when the railroad-building era opened in the seventies, for railways built in off-side areas of Ontario such as this were largely financed by money of affected municipalities. The result in the Listowel region was competitive war between communities in the seventies for railroad facilities; and soon there emerged a railway network inefficient for through traffic but important to the local scene. Under such conditions, communities were able to get facilities according to their size and wealth while the competitive war raged; and since the ability of a community in this area to attract or retain industry has depended on its railway facilities, the railway period has tended simply to emphasize the community size pattern of 1871.

Culmination of forces set moving by conditions of early settlement are illustrated in Figure 5. In the watershed belt, communities are evenly spaced along survey lines and branch roads as they were seventy years ago; variations in size are correlated with railroad facilitity. Westward, practically all communities are associated with streams at points where harnessing has been possible sometime through history, but again size is correlated with railroad facility. In the zone untouched by railroads, there is a dearth of communities today; elsewhere village distribution is erratic, small places are few. Notable, for instance, is the way in which the community southwest of Town H has suffered from its position on a bend of the Maitland branch away from the railroad course. Interesting, is the east area of Listowel which has felt influence of neither water-power nor railroad; here, supply hamlets have best survived.

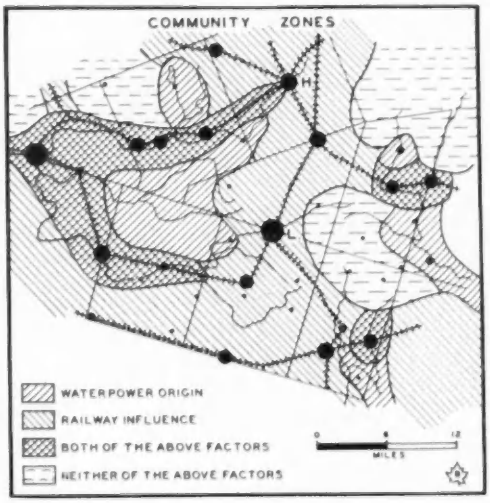

FIGURE 5.—Areas of influence by railway and water power facilities, or their lack, form an irregular pattern, as might be expected.

CONCLUSION

Expansion and survival of a community in the Listowel Region has resulted from the following factors in its history:

(1) Original need for its existence;

(2) Advantage of site in the pioneering period;

(3) Size it had achieved at time of coming of the railways;

(4) Ability, through achieved size and new railway facility, to attract industry, commerce, and labor.

The historical sequence of the four points is the basis for most of the towns and villages of today. To explain precise location of individual communities we must turn to factors determining advantage of site at time of settling; while to understand community pattern as regards present *size* distribution we must analyze historical sequence right from the earliest days. A map of today showing all physical and cultural features of the Listowel Region could not explain the present community pattern; the time factor is the key to solution of the problem.

CITIES OF CENTRAL MISSOURI

Robert M. Crisler

LOCATED in the ten counties of Central Missouri are eight urban centers, each having more than 5,000 but less than 25,000 inhabitants. They lie between St. Louis to the east, and Kansas City to the west, by which they have been overshadowed in their development. Is it likely that any one of them can ever become a metropolitan center, or will Central Missouri continue tributary to St. Louis and Kansas City? between the Ozarks to the south and the Corn Belt to the north and west. Steep hills southward grade into rolling hill land to the north and west. The best agricultural land lies in the floodplain of the Missouri River which cuts through the heart of the area. The Missouri very early served as an easy route from St. Louis westward. It failed, however, to contribute appreciably to the growth of large cities in Central Missouri

Urban Centers of Over 5,000 in Central Missouri	*Population 1940*	*Population 1930*	*Population Change 1930–1940*	*Population % Increase 1930–1940*
Jefferson City	24,268	21,596	+2,672	+12
Sedalia	20,428	20,806	−378	−2
Columbia	18,399	14,967	+3,432	+23
Moberly	12,920	13,772	−852	−6
Mexico	9,053	8,290	+763	+9
Marshall	8,533	8,103	+430	+5
Fulton	8,297	6,105	+2,192	+36
Boonville	6,089	6,435	−346	−5

Located near the confluence of the Missouri and Mississippi Rivers, the focus of Mississippi Valley trade routes, St. Louis was able to attain early prominence during the days of river transport, and to maintain such position with coming of the railroad, highway, and airplane. Kansas City, which grew up at a sharp bend in the Missouri River where it makes an abrupt change in its general direction, easily attained early prominence as focus of trade routes leading westward and southwestward. No similar reason favored the development of large urban centers between these two great cities.

Central Missouri is a mixed farming region with livestock and corn predominant. It lies in a transition zone because no important trade routes from the north or the south intersected it. Instead, it has actually retarded urban growth. Floods are frequent; its course is subject to change; and it has lost much of its importance as a transportation route. Jefferson City and Boonville, the two Central Missouri cities located on the river, have developed on bluffs, and though their topography appears pleasing to the eye, industrial growth is impeded due to lack of level land. Neither city has expanded onto the floodplain across the river from its original site.

Trade routes in Central Missouri follow an east-west direction. The Missouri River and all major railroads and highways connecting St. Louis and

Kansas City traverse the region. There is no direct railroad connection between the area and the Ozarks to the south. Air transportation is still little developed, though Columbia and Moberly have modern airports and hope to have very good air connections in the near future.

All eight cities are retail trade centers. All but Moberly are county seats. Jefferson City, largest of the eight, is political center of the state. Columbia and Fulton are chiefly educational centers. Sedalia, Moberly, and Mexico have the best railroad service and can be classed as railroad centers. They are the only cities in Central Missouri that have important manufacturing. Of the eight cities, only Jefferson City, Columbia, and Fulton, had a population increase of more than ten per cent between 1930 and 1940.

Jefferson City is a trade center located on the Missouri River, and the home of the state capitol, state penitentiary, and

FIGURE 1.—Cities of Missouri selected to illustrate the statements made in the text. Each has more than 5000 inhabitants but fewer than 25,000.

Lincoln University for Negroes. Because of its location, Jefferson City is called the northern gateway to the Ozarks and has possibilities of trade expansion into

FIGURE 2.—A section of railroad yards at Sedalia. The city depended altogether too much for its prosperity upon the railroad shops located there and consequently suffered in the depression of the 1930's.

that area. In this expansion, however, Jefferson City can hardly compete with St. Louis, which has easy access to the Ozarks by the Meramec River route, or with Springfield, which is well established in the heart of the better agricultural lands of the Ozarks. After the founding of Jefferson City in the 1820's, it had a slow growth. Competition from Sedalia for the capitol even raised serious doubts for the city's future until 1917, when the present capitol building was completed. The position of the city was more firmly established when, by the Constitution of 1945, seats of many state boards and commissions were fixed permanently at Jefferson City. Capitol of the tenth most populous state, Jefferson City ranks 35th in population among political centers of the 48 states.

Columbia and Fulton, primarily educational centers, showed greatest percentage increase in population of Central Missouri cities between 1930 and 1940. Columbia is seat of the state university, two large junior colleges for women, and the state cancer hospital. Fulton is seat of a men's college, a women's junior college, a state school for the deaf, and a state hospital. Fulton is noteworthy for its lack of transportation facilities, being served by only one federal highway, and a branch railroad line from Mexico. It

is somewhat overshadowed by its proximity to Jefferson City and Columbia. Continued growth of Columbia and Fulton depends upon continued expansion of their educational institutions and upon better transportation facilities. Columbia may soon become a stop on a St. Louis-Columbia-Kansas City airline.

Two cities, Mexico and Marshall, showed only small population increase from 1930 to 1940. Mexico advertises itself, with at least some justification, as the "Fire Brick and Saddle Horse Center of the World." The fire brick industry is based on local brick clays, the industry producing refractory products with a world-wide market. Auction sales held by local breeders and trainers of fine saddle horses attract buyers from areas beyond the immediate region. Mexico's growth depends, for the most part, upon continued demand for refractory products produced there. Marshall has a shoe factory, two food processing plants, one small college, and a state institution. Inadequate city water supply which hindered the town's growth, has been adequately increased. But even so, there is little prospect of Marshall assuming anything but local importance.

FIGURE 3.—Missouri River at Boonville. The oldest city of the region and dependent upon its river trade for prosperity, it lost importance with the building of railways.

Three of the cities, Sedalia, Moberly, and Boonville, lost population between 1930 and 1940. All three stand a good chance of checking this decline between 1940 and 1950. Sedalia, which has been slowly declining in population since it reached a peak of 21,144 in 1920, was the largest city in Central Missouri for over fifty years. Some indication of its importance and advantage of location is reflected in its being seat of the annual state fair. It owed its original growth to the location there of shops of the Missouri Pacific and Missouri-Kansas-Texas railroads. Too much dependence upon this single source of employment forced Sedalia to suffer severely during the depression of the 1930's. Its dependence has been somewhat corrected by the location there of several small industries. In such diversification is Sedalia's major hope of growth.

FIGURE 4.—Fire brick plant at Mexico. Its brick industry utilizes local clays and distributes its superior product over a wide area, well-nigh world-wide.

Like Sedalia, Moberly is a railroad

FIGURE 5.—Shoe factory at Marshall (picture taken from the rear). There is little prospect that Marshall can assume more than local importance.

town. Shops of the Wabash Railroad are located in Moberly and coal is mined in considerable quantities near by. Moberly's wholesale and retail trade area may expand more in the near future. Its expansion will largely be local, not competing with the regional trade of St. Louis and Kansas City.

Boonville is oldest of Central Missouri cities. Located on the Missouri River, Boonville's relative importance declined with the coming of the railroads and subsequent decline in its river trade. The Missouri Training School for boys and Kemper Military School are located in Boonville. Otherwise the function of Boonville is confined to local trade and local government.

No large increase in population for any cities of Central Missouri can be predicted. Though rural population in the area is relatively stable, all cities will probably grow due to natural increases and absorption of excess rural population during the decade 1940 to 1950. Most cities in the region are characterized by two or more small manufacturing establishments such as shoe factories or food processing plants, but there is little probability of their manufacturing increasing. Bases for modern manufacturing such as coal for power, cheap labor, transportation facilities, and a market, are available but to more limited degree than in other sections of the country. Jefferson City will most likely remain largest city in the region for some time to come since its position as political center of the state is secure. Columbia, growing with its educational institutions, will supplant Sedalia as second largest. Columbia and Moberly with modern airports are best prepared to grow as (and if) air transportation becomes more important. It is not likely that any smaller urban centers in Central Missouri will grow much beyond their present population. As has been indicated, state institutions have been distributed in Columbia, Fulton, Boonville, Marshall, and Sedalia, as well as in Jefferson City. They have been a factor in growth of all the cities and are reason why Jefferson City is not much larger than any of the other cities. There is no indication that any cities will cease to be overshadowed by St. Louis and Kansas City or that Central Missouri will cease to be part of the umland of the two large cities.

BOOK REVIEWS

PEARSON, FRANK A., AND HARPER, FLOYD A. *The World's Hunger*. 90 pp. Cornell University Press, Ithaca, N. Y., 1945.

MATHER, KIRTLEY F. *Enough and to Spare*. 186 pp. Harper & Brothers, New York, 1944.

Two points of view, two schools of thought, two courses of action, almost diametrically opposed, are presented by these two books. "Enough and to Spare" is the more inclusive of the two volumes, in that it discusses more or less all resources, whereas "The World's Hunger" is concerned almost exclusively with food supply. Naturally, then, the latter book is much the more specialized, the former more general. Kirtley Mather is a confirmed optimist; Pearson and Harper, so far as their book is concerned, are pessimists and realists. Their book is the more practical and vital; Mather's book is the more idealistic and philosophic. Both books are well written, convincingly and clearly. Both are necessary to a sound conclusion regarding the problems of the day that statesmen and scientists must solve. They reflect a growing appreciation on the part of the public and on the part of scientists of the responsibilities that both have for the welfare and security of the future. Neither is exhaustive, nor comprehensive, both are highly suggestive and stimulating.

"The World's Hunger" directly relates the attributes of the environment of the world, its character and quality, to the quantity and variety of food, supplies that can be produced, exchanged among the peoples, and consumed for strength and health. It is strongly geographic in its point of view. "Enough and to Spare," though based on scientific research and statistics, is much more popular in its presentation, involving geology, economics, agriculture, trade relations, and politics. The two books should be read, one after the other, preferably Pearson and Harper's first, and Mather's afterward, for the reader's peace of mind. Both books are valuable and stimulating.

W. E. E.

CURRIE, A. W. *Economic Geography of Canada*. xiv and 455 pp. The MacMillan Company, Toronto, Canada, 1945.

This is another regional book, a book of Canada's regions from the viewpoint of the economic geographer. Only 40 pages are devoted to the systematic geography of Canada as a whole, and less than half of these few pages to the economic geography of Canada as such. The rest of the book, more than 400 pages, discusses seven major regions into which the author sub-divides Canada: Acadian-Appalachian Region; St. Lawrence Lowlands; Prairie Region; Cordillera Region; Canadian Shield; Mackenzie Valley and Hudson Bay Lowlands; The Tundra; Newfoundland and the Labrador (the author takes liberty with political fact and feeling by this last "Canadian Region," to which he devotes 20 pages). The several regions are systematically and fairly adequately treated, the length of the discussion of each region apparently being an approximation of its relative significance. The relatively brief statements regarding Soils, so important in the economy of some of the regions, afford ground for criticism, particularly since Climate is rather adequately summarized for each region. In the St. Lawrence Lowlands, the Prairie Region, and parts of some of the other Regions, Soils are vitally important, and have not been so fully or carefully described in previous publications, as have the Topography and Climate.

On the whole, however, the book is satisfactory, both as a text and for reference. Such a book has long been needed, and now that it has been written, it will constitute one of the most valuable additions to the available literature on Canada that has come from the press in recent years. The book is well organized, the material has been well selected and is presented clearly and authoritatively, and though not so well illustrated as desirable, it does afford a fairly comprehensive and basic source volume of Canadian Geography. It is well bound, printed in legible type on fairly good paper, and includes a satisfactory index.

W. E. E.

GREGORY, JAMES S., AND SHAVE, D. W. *The U. S. S. R., A Geographical Survey*. 636 pp. John Wiley & Sons, New York, 1944. $4.25.

Such a book as this has long been needed. As the authors state in their preface "Unfortunately, lack of information and the difficulty of consulting original works in the Russian language relating to the economics and geography of the Soviet Union, have resulted in ignorance which has precluded the serious geographical study of that country. Students and teachers alike have found the greatest difficulty in obtaining facts upon which to base their studies and their teaching. The purpose of this book is to present those facts, and to sketch the outline of the geography of the U. S. S. R. as it is today, attempting at the same time to indicate how the Russia of today has grown out of the old Russia before 1917."

The details of Russian geography are fairly well set forth, as well as the knowledge available to the Western World, and the limitations of space, permit. Somewhat more than a third of the book is devoted to Russia as a whole, and the rest to more or less adequate and systematic treatment of the several regions into which the authors feel the great expanse of Russia should be divided. It is perhaps too much to expect that any greater detail, any more accurate description and appraisal, can be compacted within the covers of a single volume, of such a large expanse of territory and variety of terrain and climate and soils and vegetation, and such a large population as constitute Russia.

Unfortunately there are certain broad points of view and broad comparisons that might be synthesized into a better appreciation of the true character of the land and people of the U. S. S. R., as for example: 1. That Russia is a far northern country and that except for a limited portion of southern Russia in Europe, and of Asiatic Turkestan, its territory lies north of the 50th parallel, north, for instance, by a degree, of the northern boundary of the United States, and further, that a large proportion of that territory lies north of the 60th parallel, roughly the northern limit of food production by agriculture. The limitations, inexorably set by nature, and consequent upon northern location, of short growing season, low rays of the summer sun, podsolic soils and coniferous forest, are definitely restrictive upon Russia's extent and variety of crops; 2. That Russia is dominantly an inland country with little access to open sea for much of the year, and that the few significant outlets she has to the open steamer lanes of the North Atlantic, the world's great theatre of maritime activity for the past three centuries, are subject to a handicap of more than a thousand miles in competition with the states of Western Europe; 3. That the U. S. S. R. is a territory of transition between two great ethnic groups of the world, the yellow on the East and the white on the West, and between two major cultures, the Oriental and Occidental; and finally, 4. That roughly seven-eighths of Russia's great population are encompassed within slightly more than one-eighth of her area, and that beyond the boundaries of that small proportion, deficiency and untrustworthiness of rainfall set a limit to arability and habitability on the one side, and shortness of growing season imposes an equally insuperable barrier to expansion of agriculture and settlement on the other, and consequently that there are few areas that have not already been occupied or cannot be occupied permanently. These are but a few of the major conclusions that could be pointed out.

Yet on the whole, the volume is exceedingly valuable, and useful. The English-speaking world has needed just such a summary as this, an objective appraisal of the environmental complex that constitutes Russia and to which a large portion of the world's peoples and one of its most powerful states must make their economic, political and cultural adjustment.

W. E. E.

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Colombia's Petroleum Resources, Phyllis R. Griess, Pennsylvania State College.
Great Kanawha Valley, Leslie M. Davis, Marshall College, Huntington, W. Va.
Mineral Resources of Indo-China, E. Willard Miller, Pennsylvania State College.
Physical Aspects of the Laramie River Dispute, Clark N. Crain, Denver University, Denver, Colorado.
Land Utilization in Central Ontario, L. G. Reeds, University of Toronto, Toronto, Can.

The July issue includes:

French-Speaking Farmers of Southern Louisiana, Walter M. Kollmorgen, University of Kansas, Lawrence, Kansas, and Robert W. Harrison.
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